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ABSTRACT

A file folder, the drawings contained within this book, and materials such as crayons, glue, and straws are what is needed to make this resource a classroom tool for studying space-related topics with preschoolers. The activities in this book are designed to inspire preschoolers to use their creativity, inventiveness, imagination, and intuition. All activities are organized around the broader topics of the air above the earth, aviation education, and space beyond the earth. A section on space education resources is included as well as tips on integrating aviation into the curriculum. Vocabulary lists and related games and activities are provided along with background information on famous aviators, moon survival, and the planets. (DDR)

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ED 426 850

Science

Air and Space

Folder Games for the Classroom

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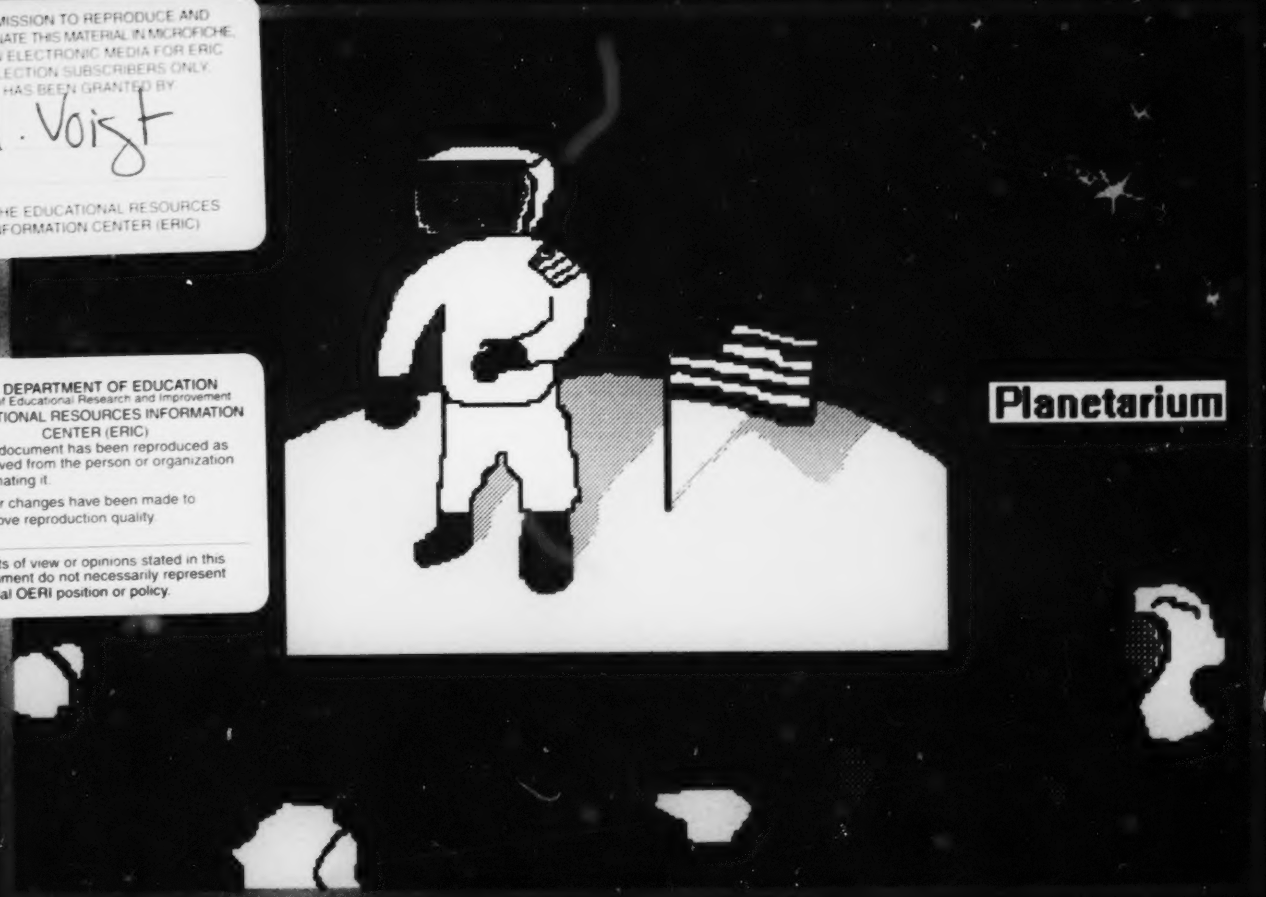

Adapted for preschool by Leah M. Hughes
based on AVIATION AND SPACE by Jane Caballero-Hodges, PhD

SCIENCE
AIR AND SPACE
ACTIVITIES:
Folder Games for the Classroom

adapted for preschool
by Leah M. Hughes

based on Aviation and Space
by Jane Caballero-Hodges, Ph. D.

Also by Jane Caballero-Hodges:
Vanilla Manila Folder Games
The Handbook of Leaning Activities for Young Children
Month by Month Activity Guide for the Primary Grades
Art Projects for Young Children
Aerospace Projects for Young Children

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Editor's Preface
SCIENCE AIR AND SPACE: experiencing our universe

Preschoolers should be discovering science with the same excitement that they have in discovering how to walk the playground's balance beam, finger-paint a picture of their home, or sing a song that proves they know their ABC's.Science should be a fun, hands-on activity that offers children interesting information that they can understand and relate to.

As the science teacher of young children, put forward all of your own creative ideas, logic, intuition, artistic sense and knowledge of the children you serve to use your best judgment about how much of the material in this book to use directly with your children. The material in Science Air and Space is not meant to be memorized and repeated, or even taught: the information and activities should inspire preschoolers to use all of their creativity, inventiveness, imagination, and intuition. They should see their classroom as the universe, and the universe as their classroom. Then, they can begin to identify the larger universe and world in which they live.

For young learners, scientific information should simply encourage the age appropriate activities of thinking, measuring, classifying, verifying, ordering, observing, using space and time relationships, reasoning, planning, feeling, dreaming, loving, valuing, drawing, imagining, singing, inventing, integrating, fantasizing, discovering, exploring -- participating in the discovery; and reading and writing if the student is at that advanced level.

The study of the Solar System, for example, should inspire you to get out the Play dough, the clay, or the plastic clay so the children can make "planets" of various sizes, and then, in the space of the area around the school building, decide where to put the "Planets" in relation to whatever they decide can represent the "Sun". The children can each pretend to be a planet, rotating around the teacher as "Sun", for another experience with the concepts to be experienced. On another day, the children can develop a poem or a song about the planets and their relationships to each other and their characteristics. Keep your imagination rolling with all of the given suggestions: you are the one who best knows how to offer the chidren you are teaching interaction that they will remember and enjoy with air and space.

Have fun with this information! You will find that the learning resources listed toward the end of the text are accessed with ease and friendly cooperation: take advantage of them. The more creative and hands-on you can be about ways to present the information, the more interaction, attention, and positive response you will receive from your children; and that, in turn, will inspire you to come up with new, different ways to investigate with your children the vast universe of information about air and space.

Leah M. Hughes, Editor

INTRODUCTION

A simple file folder, these drawings, and other classroom materials like colored crayons and glue and straws are all you need to make your Science Air and Space Folder Game Book a successful classroom tool. Feel free to customize the suggestions and activities here to individualize folders based on the student's developmental level.

These unique folders encourage the educator to take an active role in designing curriculum for students. It is not a ready-made kit that merely requires presentation.

Students can readily identify with the folders and are enthusiastic when they see their own teacher actually making them. The are motivated when allowed to create their own folders.

These practical folders are not only easy to develop, but also are easy to story and use in a learning center. Material on air and space may be new to young children, so if the folders are used as independent learning centers, be sure that you assert that the child can at any time ask for your help in understanding and completing an activity, or just obtaining the proper materials. Parental volunteers might be useful to this type of independent learning.

Be sure to use bright and colorful water-color markers. Color the initial pattern to glue to the folder's cover. Then prepare the insides of the folders either by coloring and laminating, or by making reproductions. Be sure to include all the instructions.

Please note at the end of each unit a sheet of suggestions for advanced or older learners. These activities should be employed when children are bored with the folder suggestions, when the student has a particular interest in a topic, or when, as stated, the learner is older or advanced.

Have fun learning about Air and Space!

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> The Federal Aviation Administration; Congressman Don Clausen, Director of Special Programs, and Jack K. Baker, Public Affairs/Aviation Education Officer, Southern Region.
>
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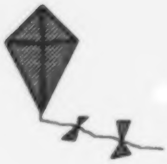
Air Above the Earth



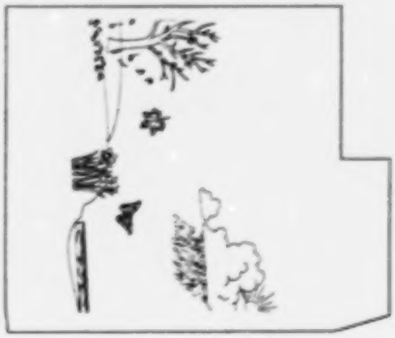
Name: **SKY**

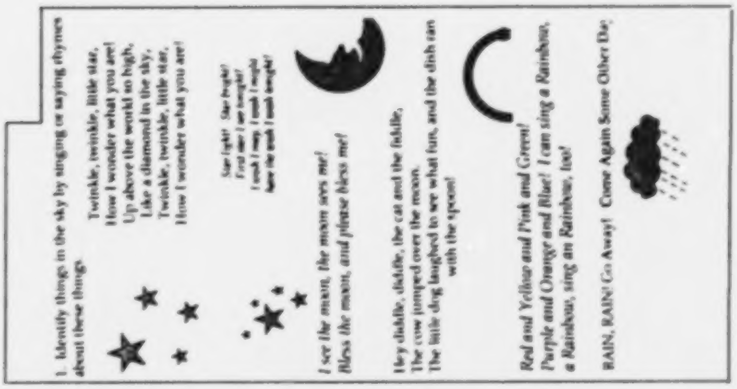
Skill: Introduction of air and space activity unit.
Identification of common shapes and things in the sky.
Art activities.

Procedure: 1. Identify things in the sky by singing about these things or repeating these rhymes.

2. Match the things you see in the sky to the word **SKY**, and match the things you see on the land to the word **LAND**.

3. Color and name the things going through the sky. Draw the things in a sky at night and a sky during the day.





1. Identify things in the sky by singing or saying rhymes about these things.

Twinkle, twinkle, little star,
How I wonder what you are!
Up above the world so high,
Like a diamond in the sky,
Twinkle, twinkle, little star,
How I wonder what you are!

Star light! Star bright!
First star I see tonight!
I wish I may, I wish I might
have the wish I wish tonight!

I see the moon, the moon sees me!
Bless the moon, and please bless me!

Hey diddle, diddle, the cat and the fiddle,
The cow jumped over the moon.
The little dog laughed to see what fun, and the dish ran
with the spoon!

Red and Yellow and Pink and Green!
Purple and Orange and Blue! I can sing a Rainbow,
a Rainbow, sing an Rainbow, too!

RAIN, RAIN! Go Away! Come Again Some Other Day

1

1. Identify things in the sky by singing or saying rhymes about these things.

Twinkle, twinkle, little star,
How I wonder what you are!
Up above the world so high,
Like a diamond in the sky,
Twinkle, twinkle, little star,
How I wonder what you are!

Star light! Star bright!
First star I see tonight!
I wish I may, I wish I might
have the wish I wish tonight!

I see the moon, the moon sees me!
Bless the moon, and please bless me!

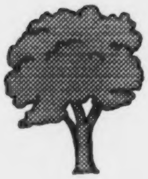
Hey diddle, diddle, the cat and the fiddle,
The cow jumped over the moon.
The little dog laughed to see what fun, and the dish ran away with the spoon!

Red and Yellow and Pink and Green!
Purple and Orange and Blue! I can sing a Rainbow, sing a Rainbow, sing an Rainbow, too!

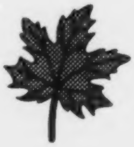
RAIN, RAIN! Go Away! Come Again Some Other Day!

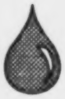
2. Looking at the cover of the folder, draw a red line from something that is in the sky to the word **SKY**.

Draw a yellow line from something that is on the land to the word **LAND**.

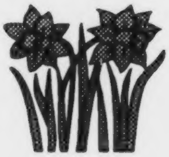


SKY



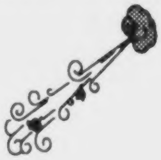


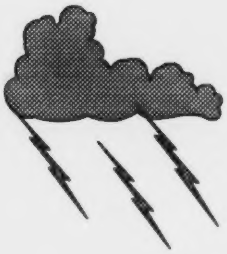
LAND



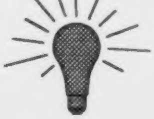
and how about these things?

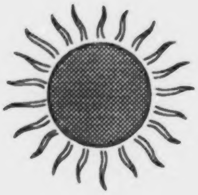
SKY

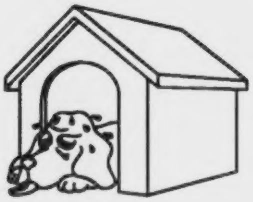




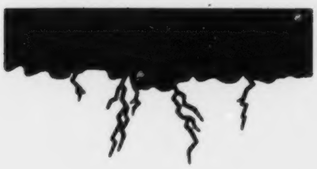
LAND

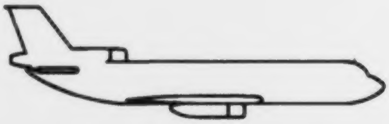


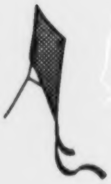


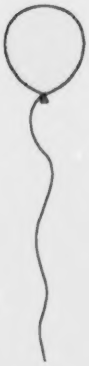


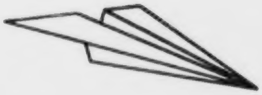
3. What things do you often see in the sky?
Color them and write their names under them.











And what about:

Name some things you see in the sky in the daytime.
Draw a picture of a sunny, rainy or snowy day.
Name some things you see in the sky in the nighttime.
Draw a picture of a night sky.

SKY for advanced learners

Skill: Reading and writing

Procedure: 1. Look up the word SKY in the dictionary. Write down the definition and add anything you can think of that might be missing.

2. Look up the word SKY in the encyclopedia. Make a list of the things the article describes as part of the sky. Look in the dictionary for a definition of an element in the sky that you might not know. Label what things are natural and what things are man-made.

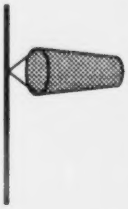
3. Take a good look at the night sky. Note what you see and either draw or write about it.

Name: **AIR**

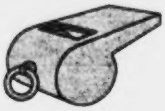
Skill: Learning about air, what it is and what it can do and what we can do with it, is essential to understanding about aviation, aerospace, and travel above the land and sea.

Procedure:
1. Explore the properties of air using the toys suggested.
2. Explain air property using suggested activity.

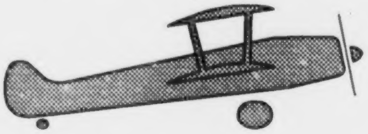
An effective way to let your students learn about air is to gather toys and equipment and spend a day letting the children explore the properties of air. We suggest the following "toys:"



balloons
whistles
paper or model airplanes
pinwheels
glasses (unbreakable) full of water
badminton shuttlecocks
wind socks
miniature parachutes



Additional toys may include paper or balsa gliders, rotor blades, boomerangs, bubble blowers, clear plastic tubing, ping pong balls, vacuum cleaner hose, gallon milk jugs, dandelion heads (seeds), helicopter blade type seeds, and Frisbees. Any item you can see as demonstrating the properties of air will offer children hands-on experience with air and give them a better understanding of this invisible element.



Here are some things about air that your students can observe, as they work with the objects:

1. Air has mass.

How can you tell air has mass? It is invisible, so how do you know it is there, if you can't see it? Air is composed of particles of gases, in a mixture.

Exercise: Blow up a balloon. Can you see the air inside the balloon? Can you see the air going in or coming out? Can you feel the air inside the balloon, going into the balloon, or coming out of the balloon?

2. Air has volume.

How can you tell that air takes up space? If you wave your hands in the air, what space is the air taking up?

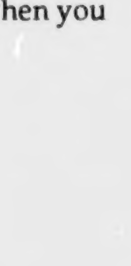
Exercise: Take a deep breath: fill your lungs with air. Breathe, moving the air in and out of your lungs, and feel for yourself how much space air can take up.

Variation: Blow up balloons, sandwich bags, water wings, a beach ball, or other items to see how the item changes shape when they are filled with air. How do they feel when filled with air and not filled with air.

3. Air can move.

How can you tell that air is moving? Air flows or is fluid, much like water. You can study water to learn how air flows.

Exercise: Fan yourself with a paper fan. Do you feel the air moving? Stand in front of an electric fan; do you feel the air? Does the air focus on a certain part of the room or your body?



Variation: Watch how fast a pinwheel moves when you blow on it. Will it move if you run water over it?

4. Air exerts pressure.

How do you feel the pressure of air? Do you feel the pressure of air when you push on an inflated beach ball?

Exercise: Put a piece of cardboard over a full glass of water. Turn the glass and cardboard upside down. Take away your hand. What holds the water in?

Variation: Using a straw, blow a dime, a paper clip, a small paper cup, a pencil, or any item across the table. Does it move? How far? How fast? What happens if you blow softly or slowly? What happens if you blow hard?

5. Air lifts.

How can you see air lift? How do you know that the air is lifting and not something else?

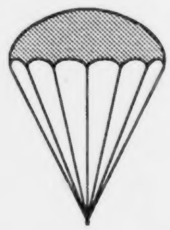
Exercise: Put a flat balloon or sandwich bag under a book. Blow air into the balloon or bag. What happens to the book?

Variation: Blow air into a miniature parachute. See if you can make the parachute rise. Fly gliders and paper airplanes to see if you think the air lifts them.

6. Air changes velocity or speed.

Air can have a changing or steady air flow. You can see the change of speed by observing a piece of paper or an electric fan or the wind.

Exercise: Fan yourself for a moment. Fan yourself slower and faster. Do you see the change in the speed of the air? Or, stand in front of an electric fan. Have your teacher or parent change the speed of the fan so that you can feel the difference when it is running at faster and slower speeds. Or, on a windy day, sit outside. Try to count and name the things you see moving from air: trees, bushes, hanging signs? How many things do you see flying: leaves, pieces of paper . . . ?



7. Air rises when heated.

When air is heated it rises, because it becomes lighter.

Exercise: Put a balloon over the neck of a bottle. Put the bottle into hot water. See if air fills the balloon. Then, put the bottle into a bowl of ice. What happens to the balloon?

Variation: Use a hot hair dryer to show hot air rising. Hold a ping-pong ball over the nozzle of the hair dryer, turn the hot air on, and see what happens to the ping-pong ball. What if you turn on the cold air setting of the hair dryer?

8. Air has direction.

Air can move in different directions, which can change.

Exercise: Observe a wind sock, a weather vane, or a flag, to see the changing direction of air.

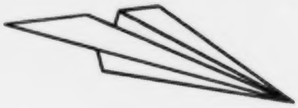
Variation: Blow through a straw. How many directions can you blow in. Using a straw, blow water colors on a piece of paper to make a picture; does the paint go up, down, sideways. . . ?

9. Wind is lots of air.

Wind is a mass of air that has speed, which can change.

Exercise: How does the wind affect objects we throw? On a windy day, go outside and throw a football, a paper airplane, a kite, or different kinds of Frisbees. How does the wind interfere?

Additionally, students respond well to exploration and learn by doing. Make available the various toys, including musical instruments that operate by air (Kazoo, flute, recorder, trumpet) and allow the children to discover properties of air by doing.



AIR for advanced or older learners

Skill: Exploration of scientific facts.

Air is all around us, on Earth.
Air fills our space.
Warm air rises.
Cold air drifts down.
Convection currents result when warm air rises and cold air drops.
Air weighs five quadrillion tons.
The air in an average room weighs 75 pounds.

Procedure: 1. Look. Air has weight. How can you see that air has weight? Weigh a deflated beach ball. Write down the weight. Then fill the beach ball with air, and weigh it again. Write down the weight. What is the difference?

2. Air has density, which can change. Air can be compressed or squeezed into small containers. Can the air in the beach ball from the first exercise be released to inflate a small balloon? a paper bag?

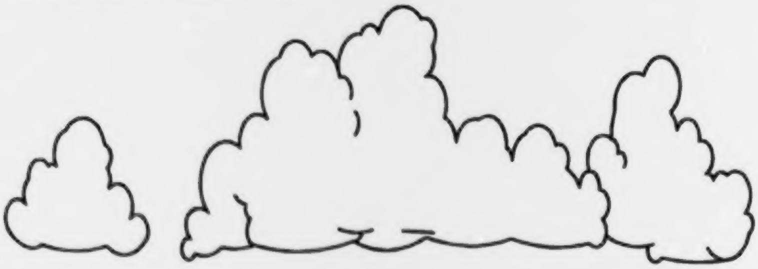
3. Air has volume. Look up "volume" in the dictionary. Now try to see how many shapes you can make with air: blow bubbles or make balloon animals.

4. Wind is air in motion, due mainly to weather effects caused by the Earth turning on its axis, dragging some air with it and causing currents. The direction of the wind can change, depending on circumstances.

experiment: Fly a kite or a Chinese Windsock to test the idea that air changes direction. Test different kinds of Frisbees to find out which type (style, size, shape) flies fastest, farthest, highest, straightest. . .

What else do you observe about the wind?

CLOUDS

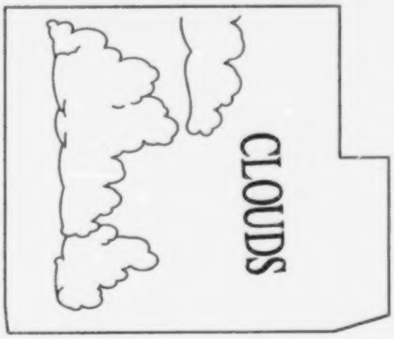


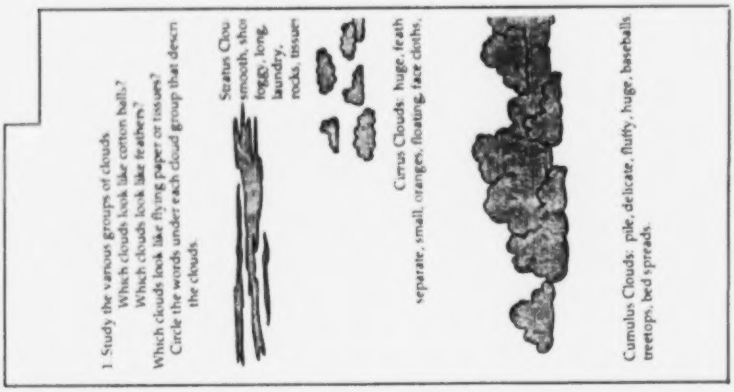
Name: **CLOUDS**

Skill: Identification of natural and familiar objects, and science knowledge.

Procedure:

1. Study the various groups of clouds. Which clouds look like cotton balls? Which clouds look like feathers? Which clouds look like flying paper or tissues? Circle the words under each cloud group that describes the clouds.
2. Some clouds look like things we recognize or see daily. Identify by coloring what you see in each cloud.
3. Clouds produce many things. Using the clouds drawn for you, what can come out of a cloud?





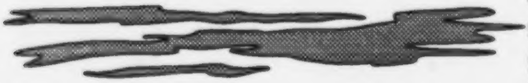
1 Study the various groups of clouds.
Which clouds look like cotton balls?
Which clouds look like feathers?
Which clouds look like flying paper or tissues?
Circle the words under each cloud group that descri
the clouds.

Stratus Clou
smooth, sho
foggy, long,
laundry,
rocks, tissue

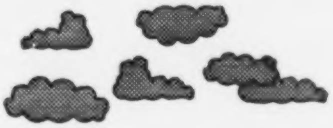
Cirrus Clouds: huge, feath
separate, small, oranges, floating, face cloths.

Cumulus Clouds: pile, delicate, fluffy, huge, baseballs,
treetops, bed spreads.

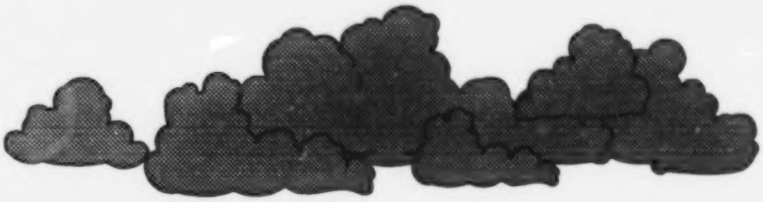
1. Study the various groups of clouds.
Which clouds look like cotton balls?
Which clouds look like feathers?
Which clouds look like flying paper or tissues?
Circle the words under each cloud group that describes the clouds.



Stratus Clouds:
smooth, short,
foggy, long, water,
laundry,
rocks, tissues?

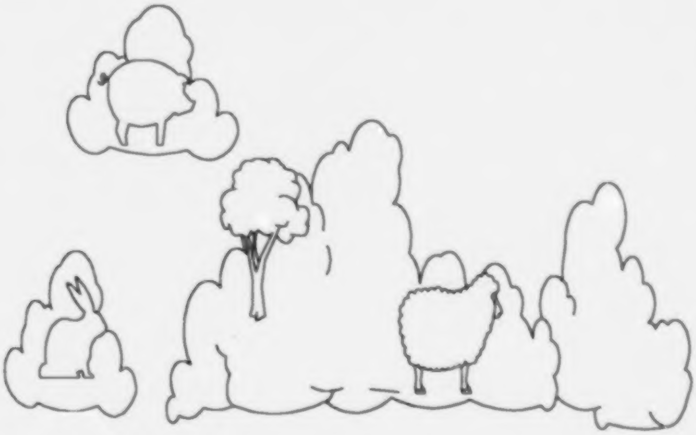


Cirrus Clouds: huge, feathers,
separate, small, oranges, floating, face cloths, grass?

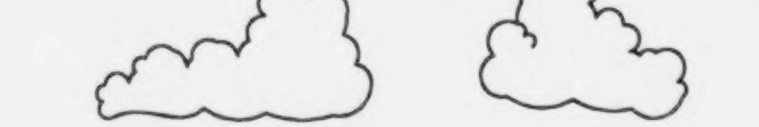


Cumulus Clouds: pile, delicate, fluffy, huge, baseballs,
treetops, bed spreads.

2. Some clouds look like things we see daily. Identify the things you recognize by coloring as you see them in each cloud.



3. Clouds produce many things. Using the clouds below, draw what can come out of a cloud. Here are some suggestions: rain, snow, lightning, partly sunny, raining cats and dogs. . . or anythings else you can think of!



CLOUDS for advanced or older learners

Skill: Increasing vocabulary and science knowledge. Word identification. Exploration of scientific facts.

Procedure: 1. Study the various cloud symbols. Clouds are formations in the sky. There are four different types of clouds, each having its own distinct characteristics.

a. *Cumulus* means "accumulation" or "pile." Cumulus clouds vary in size, growing into huge, puffy, white masses. They can be very near to the earth's surface or tower thousands of feet into the sky.

b. *Cumulonimbus* clouds are very dangerous to pilots. They are cumulus clouds that change into dark thunderstorms, and are extremely turbulent, formed by rising air currents.

c. *Stratus,* meaning "spread out" form layers like fog, and are seldom above 6500 feet. They are common when the air is still.

d. *Cirrus* clouds are in the upper levels of the sky, usually between 20,000 and 50,000 feet, and are composed of ice crystals that have a delicate, curly appearance like feathers.

2. See if you can find the eight words hidden in the following puzzle: stratus, cumulus, cirrus, cloud, thunderstorm, fluffy, fog.

THUNDERSTORMSROC
ETCBCIRROSTRATUS
QFLUYOKCHCRLCNTI
HOIMFRWICUMULUSU
RGAINYARHYNROWZL
PFLUFFYRSWTUUAOS
VCLUUEAUOBFMDTRI
ALRLERKSQBEAYGRV

Balloons

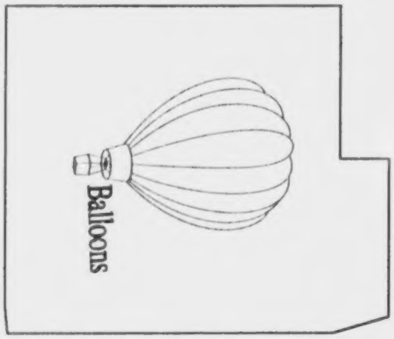
Name: **BALLOONS**

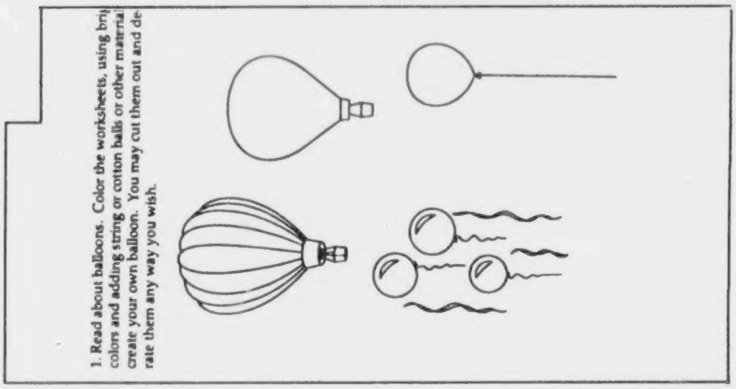
Skill: Expansion of science knowledge, balloon knowledge. Art activity and imagination exercises.

Procedure: 1. Read about balloons. Color the worksheets, using bright colors and adding string or cotton balls or other materials to create your own balloon.

2. Experiment with some balloons. Find out what happens with different sizes and different kinds of air and gases.

3. Imagine your own story about a balloon. Tell or write your story or draw a picture.

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create your own balloon. You may cut them out and de
rate them any way you wish.

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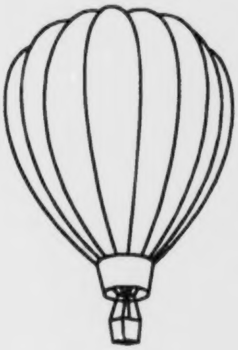
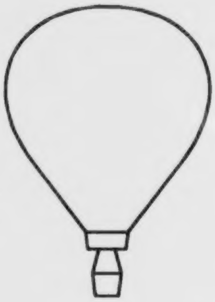
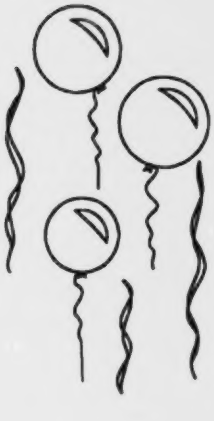
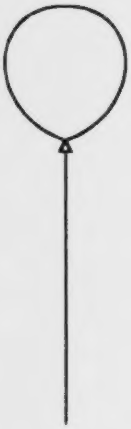
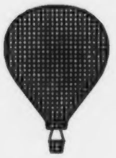










Here is a story about balloons:

A balloon can rise because a gas used inside the bag is much lighter than the air around it. The main gases used are hydrogen, helium, and heated air. Hydrogen is the lightest gas, so it has the ability to lift the balloons the highest. But hydrogen is flammable, and since that is dangerous, helium is safer to use because it will not catch on fire.

Riding in a hot air balloon is a sport for many people who enjoy the thrills and adventures of floating in the air. Did you ever think the group of balloons at a party could lift you off the ground? Hot air balloons can lift you off the ground, in a basket. But hot air balloons are hard to drive, since you have to consider air currents and altitude.

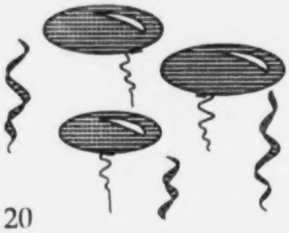
The first hot air balloons were made of silk or cotton, made airtight with a coating of rubber. Those balloons could cost from $5,000 to $20,000. Today, hot air balloons cost between $10,000 and $25,000.

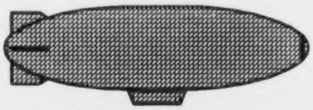
The first flight of a hot air balloon happened in France in 1783 by the Montgolfier brothers. So, today hot air balloons are sometimes called Montgolfiers.

2. Experiment with some balloons. Find out what happens with different sizes and other gases.

3. Imagine your own story about a balloon.

Tell or write your story or draw a picture about balloons.





BALLOONS for advanced or older learners

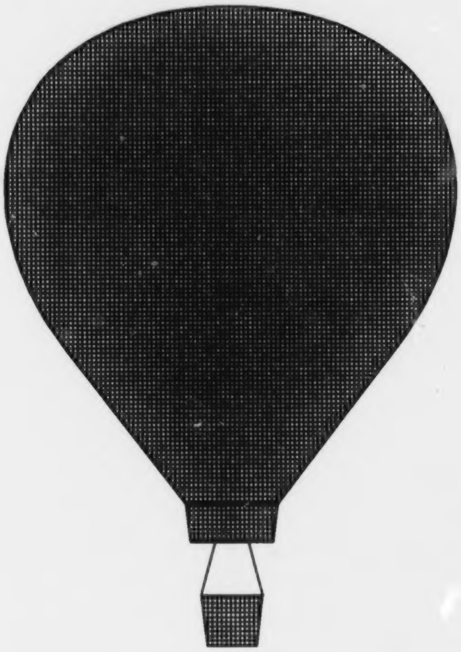
Skill: Further balloon exploration. Art experiments.

Procedure: 1. Look up in the encyclopedia about hot air balloons and read all the details of the first balloon flight.

2. Cover a blown-up balloon in paper mache. Paint and decorate your balloon. Attach a basket at the bottom with string.

3. Create a model on paper of a hot air balloon. Make interchangeable construction pieces to design the balloon in many different ways.

4. Attach a note with your address to a helium balloon. Release the balloon and see if anyone receives it and writes you.



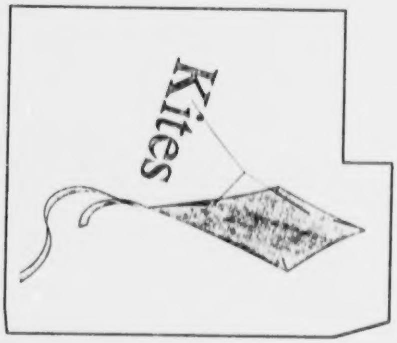
Kites

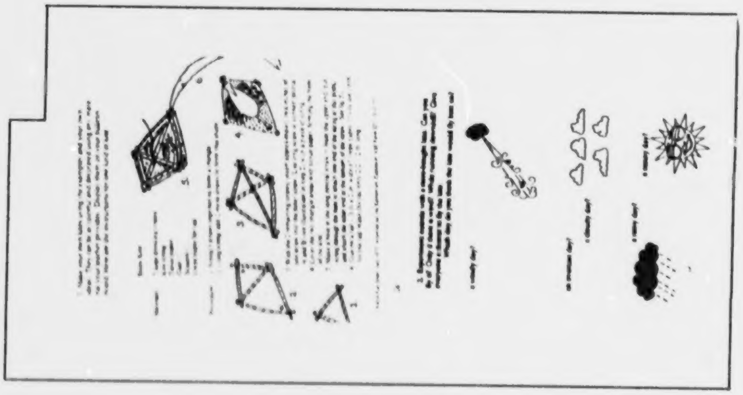
Name: **KITES**

Skill: Learning the science of flying and air. Art experiences.

Procedure: 1. Make your own kites using the examples and your own ideas. They can be as colorful as you wish, and decorated by using any materials your teacher provides. Display them on your bulletin board.

2. Experiment outside with a store-bought kite. Can you fly it? Only if there is wind? While running downhill? Give everyone a chance to fly the kite.





BEST COPY AVAILABLE

1. Make your own kites using the examples and your own ideas. They can be as colorful and decorated using any material your teacher provides. Display them on your bulletin board. Here are the instructions for one kind of kite:

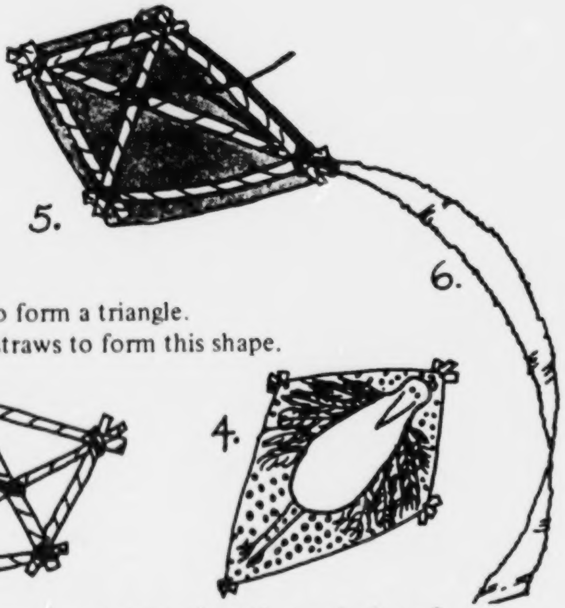
Straw Kite

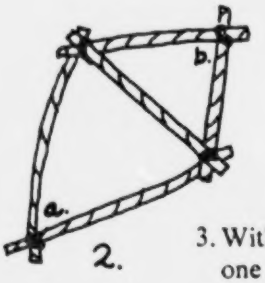
Materials

- 7 large drinking straws
- Kite string
- Tissue paper
- Glue
- Scissors
- Crepe paper for tail

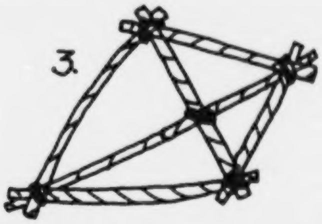
Procedure

1. String 3 straws together to form a triangle.
2. Using string, add 2 more straws to form this shape.



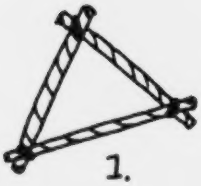


2.



3.

3. With the 2 remaining straws, insert approximately two inches of one straw into the other straw. Use long straw to connect points A and B (see illustration in step 2) with a piece of string.
4. Cover the two triangle areas with tissue paper, forming the front of the kite.
5. Make a hole in the long central straw ⅓ from the upper end, put string through the hole to attach one end of the string at this point, and attach the other end at the bottom of the straw. (See fig. 5).
6. Glue on a tail – 3 ft x 2 in. wide of crepe paper. If you use cloth for the tail, make the tail only 2-2 1/2 ft. long.



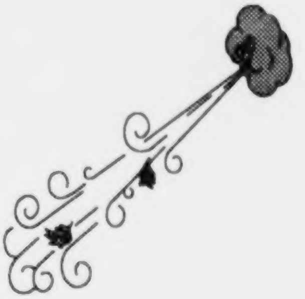
1.

NASA Fact Sheet, July 1977, Activities for the Elementary Classroom. KSC Form OT-315 (5/75).

2. Experiment outside with a store-bought kite. Can you fly it? Only if there is wind? While running downhill? Give everyone a chance to fly the kite.

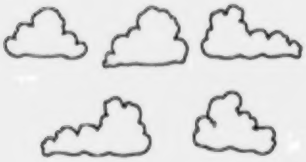
Which day do you think the kite would fly best on?

a windy day?



an overcast day?

a cloudy day?



a rainy day?

a sunny day?

KITES for advanced or older learners

Skill: Increasing science knowledge. Exploration of scientific facts and historical events and artifacts.

Procedure: 1. Using library resources, study the history and different types of kites used by the Chinese, Japanese, Europeans, and Americans.

2. At a craft store or in the library, find the instructions for making a different kind of kite. Make and fly it. Coordinate a kite flying contest with your classmates!

Airplane Flight

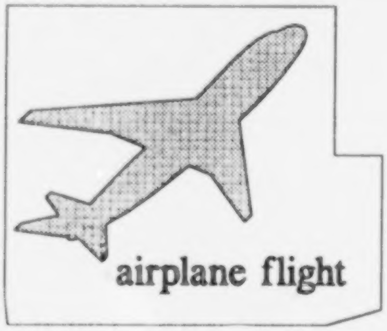
Name: **AIRPLANE FLIGHT**

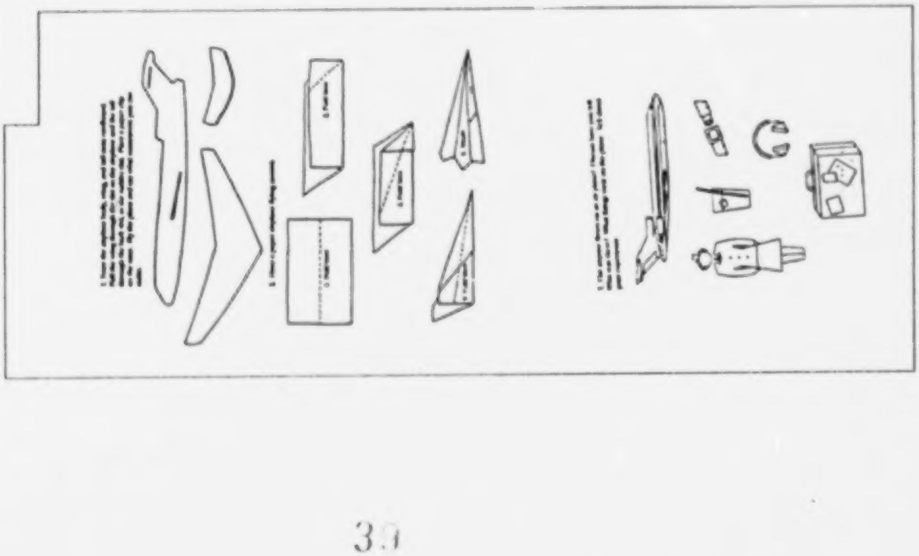
Skill: Fine motor development; demonstration of flight principles.

Procedure: 1. Trace the airplane body, wing, and tail onto cardboard. Pull the wing through the slot on the airplane and the tail through the back slot, or the rudder slot. Place a paper clip on the nose. Fly the plane and see what maneuvers you can make.

2. Have a paper airplane flying contest.

3. Has anyone flown on an air plane? Discuss how you felt. Who was there? What things were on the plane. Tell about your experience.





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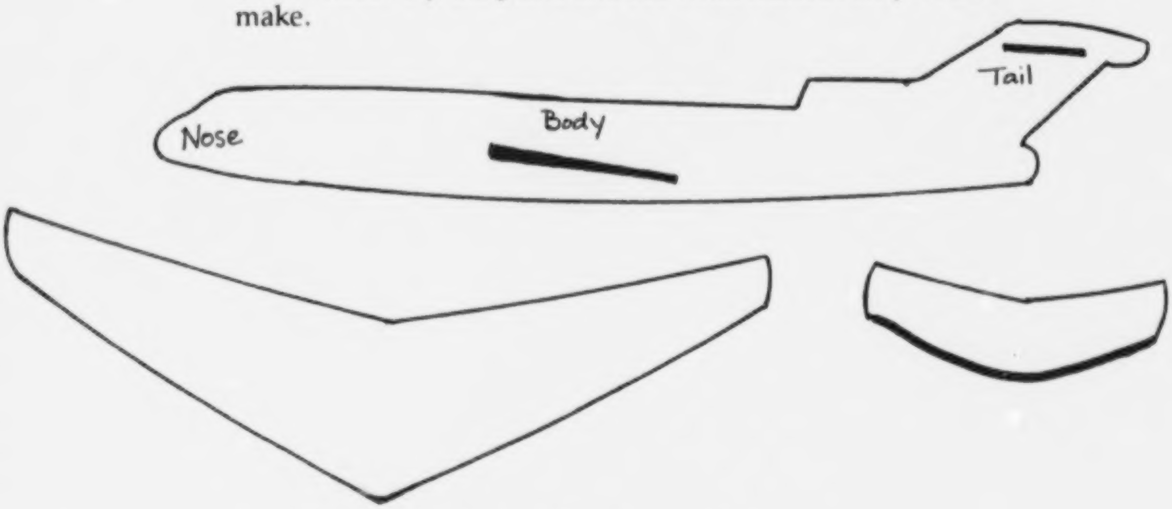
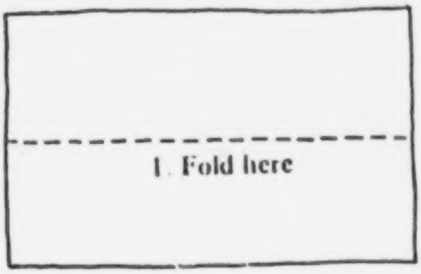
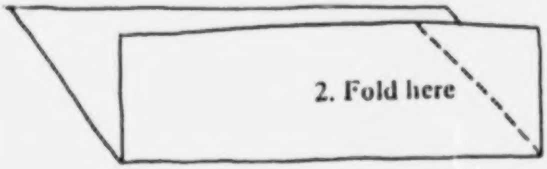
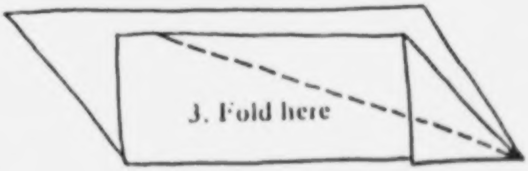
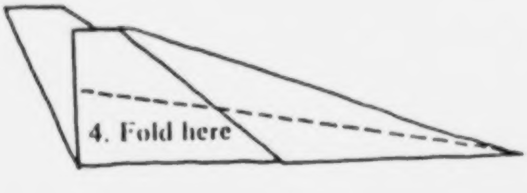

Nose
Body
Tail

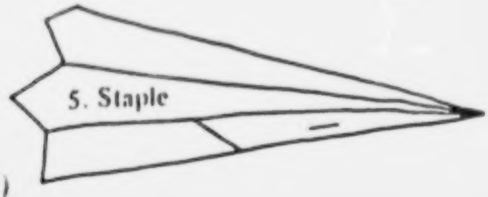
2. Have a paper airplane flying contest.



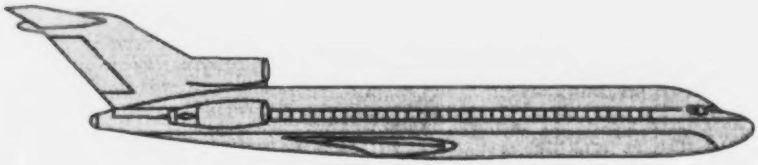


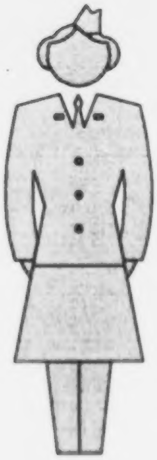


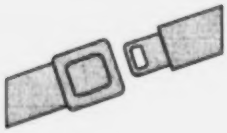


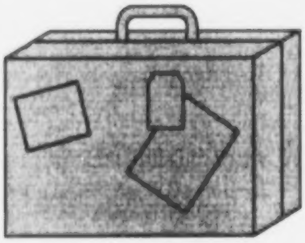


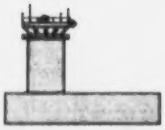
3. Has anyone flown on an air plane? Discuss how you felt. Who was there? What things were on the plane. Tell about your experience.











AIRPLANE FLIGHT for advanced or older learners

Skill: Increasing science knowledge. Story telling.
First hand learning.

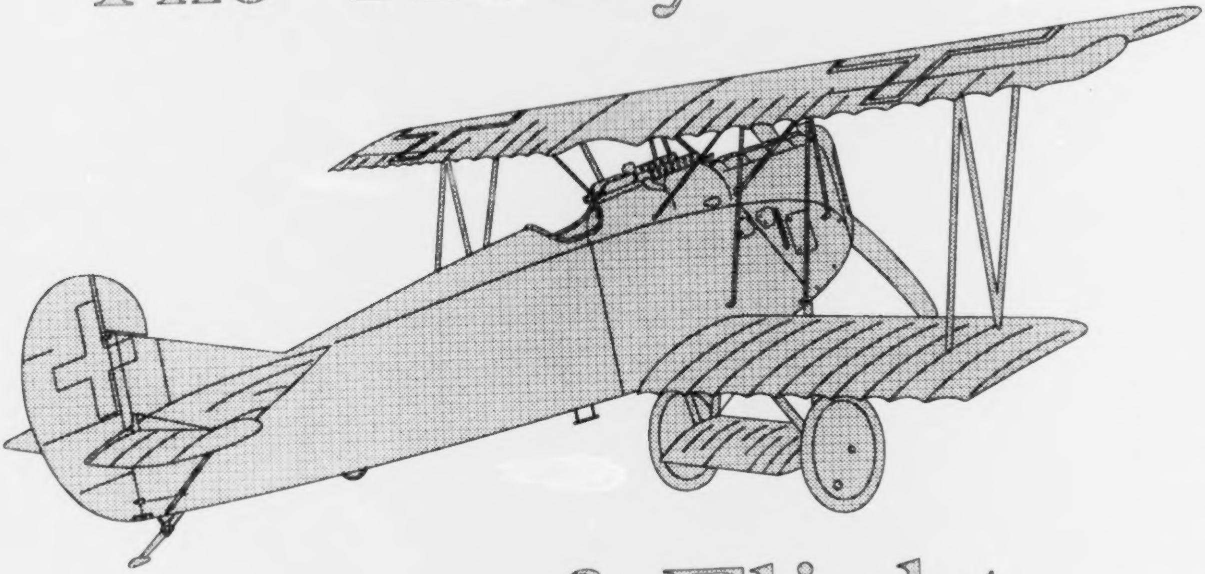
Procedure: 1. Cut the shapes for your airplane out of Styrofoam meat trays. Your teacher may need to help you insert the wing and rudder into the plane with a knife or razor blade. Use a paper clip on the nose to help stabilize the plane.

2. Tell about an airplane flight, one that you have been on or that your parents have been on, or one that you thought up yourself, or one that you read about in the library.

3. Visit the airport with your parents or class. Make note of the signs, the people, the things the people have, the food, the planes, the airline personnel, and any other things that interest you. Write about it or draw a picture.

Aviation Education

The Theory of Flight



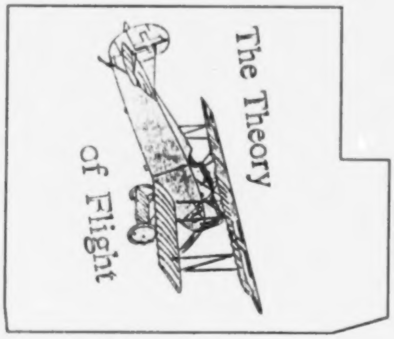
Name: **THE THEORY OF FLIGHT**

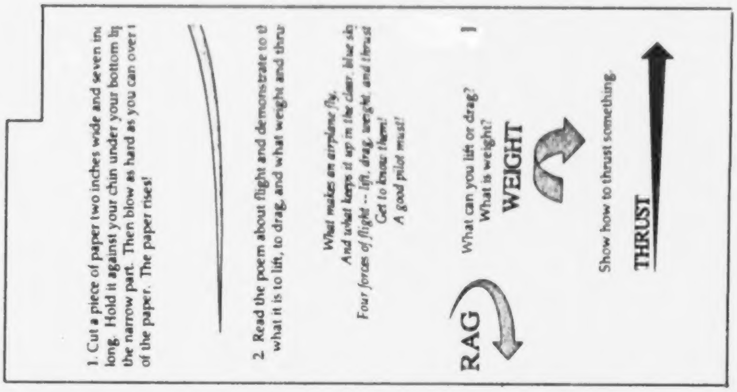
Skill: Aviation education. Science experiments. Reading comprehension.

Procedure: 1. Cut a piece of paper two inches wide and seven inches long. Hold the side that is two inches wide against your chin under your bottom lip. Then blow as hard as you can over the top of the paper. The paper rises!

2. Read the poem about flight and demonstrate to the class what it is to lift, to drag, and what weight and thrust are.

3. Read about the theory of flight. Imagine the piece of paper as being a huge, heavy plane.





1. Cut a piece of paper two inches wide and seven inc
long. Hold it against your chin under your bottom li
the narrow part. Then blow as hard as you can over t
of the paper. The paper rises!

2. Read the poem about flight and demonstrate to th
what it is to lift, to drag, and what weight and thru

What makes an airplane fly,
And what keeps it up in the clear, blue sk
Four forces of flight -- lift, drag, weight, and thrust
Get to know them!
A good pilot must!

What can you lift or drag?
What is weight?

Show how to thrust something.

1. Cut a piece of paper two inches wide and seven inches long. Hold it against your chin under your bottom lip with the narrow part. Then blow as hard as you can over the top of the paper. The paper rises!

2. Read the poem about flight and demonstrate to the class what it is to lift, to drag, and what weight and thrust are.

What makes an airplane fly,
And what keeps it up in the clear, blue sky?
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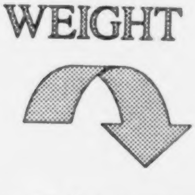


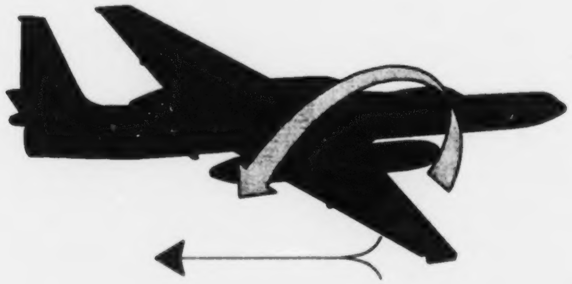
Show how to thrust something.

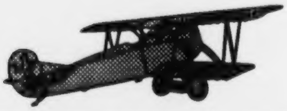
3. Read about the theory of flight. Imagine the piece of paper as being a huge, heavy plane.

To understand the theory of flight you should understand Bernoulli's law. You can prove his law with an experiment that shows that you how you can lift something into the air with moving a gas -- your breath! What actually happens is the air you blow over the paper is in a hurry, so the top of the paper has less pressure. The air pressure under the paper is greater and lifts the paper up! (for more on Bernoulli's law, see the advanced learner page.)

If you take the same paper and just pull it through the air, it will rise again. Try this with some crepe paper or a light cloth.

The wing of an airplane rises when it is pulled through the air by an engine, just as the paper is pushed up by greater pressure below. The air moving over the curved wing goes faster than the air going under the wing. Since the pressure on top of the wing is less than the pressure under the wing, the plane lifts up!





THE THEORY OF FLIGHT

for advanced or older learners

Skill: Increasing science knowledge.

Procedure: 1. Study the idea of Bernoulli's Law and Level Flight at Constant Speed. Learn about center of gravity. You may look terms up in the library encyclopedia or dictionary, or read the following.

Bernoulli's Law

Bernoulli's Law states the principle that where the speed of a moving gas is high, the air pressure is low. Where the speed of a moving gas is low, the pressure is high.

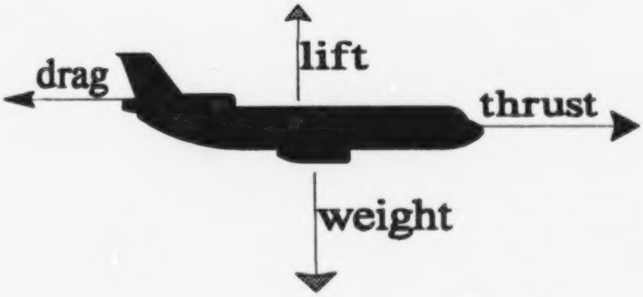
Flight at Constant Speed

The *Center of Gravity* (CG) is the balance point of the aircraft. To help understand how an airplane flies, all the forces shown can be thought of as acting on or through the CG. When an airplane is cruising in straight and level flight at constant speed, all the forces acting on it must add up to zero (by *Newton's First Law*). That is, the upward force called *lift* must be just enough to support the downward force called *weight*, and the forward force called *thrust* must be just enough to overcome the rearward force called *drag*.

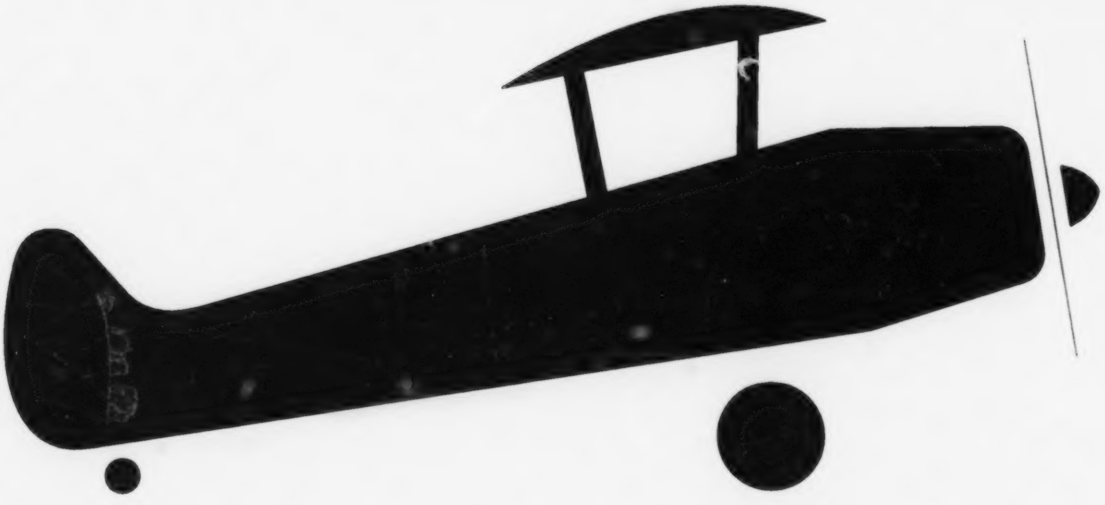
Weight, being due to the pull of gravity, is always present and always acts in a downward vertical direction. *Lift*, as we have seen, will result from the difference in air pressure above and below the wings which occurs when they move forward through the air (due to *Bernoulli 's Law*). In order for the airplane to move forward, of course, the engine must provide *thrust* through the *pull* of a propeller (or through the *push* of a jet engine). However, friction between the air and the airplane then acts to impede the forward motion, as is implied by the term *drag*.

When the pilot chooses a particular cruising speed for a trip, he will adjust the wing shape slightly by means of *flaps* and *ailerons* to produce the required amount of *lift* at that air speed (enough to just balance the airplane's *weight*). At the same time he will adjust the engine power so that it produces exactly the right amount of *thrust* to overcome the degree of *drag* that occurs at that speed.

In this simplified ideal picture, the forces all cancel and the airplane therefore proceeds at constant speed through the air on a straight path. Under more typical flight conditions, winds blowing across the desired direction of travel requires the pilot to frequently adjust the airplane controls. In modern airplanes, such adjustments to correct for unpredictable air conditions are often made automatically by a computerized system called the *auto pilot*.



The First Flight

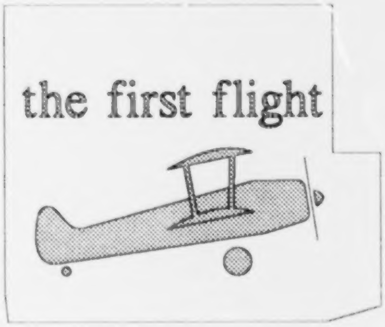


Name: **THE FIRST FLIGHT**

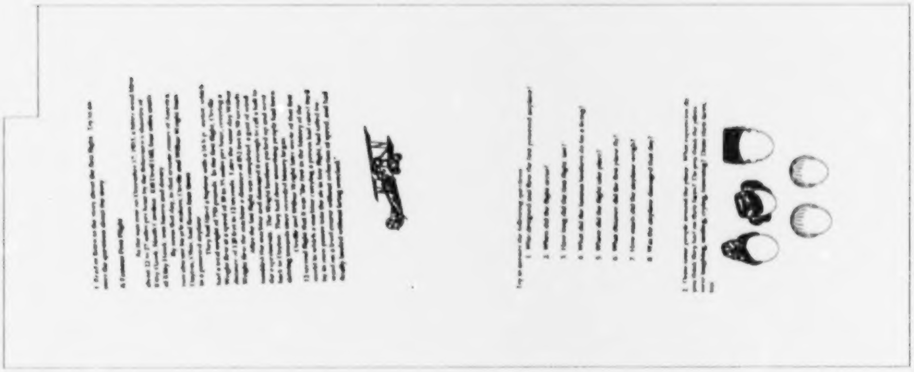
Skill: Reading comprehension. Art Activities.

Procedure: 1. Read or listen to the story about the first flight. Try to answer the questions about the story.

2. Draw some people around the first plane. What do you thing they had on their faces? Do you think the pilots were laughing, smiling, crying, frowning? Draw their faces, too.



the first flight



1. Read or listen to the story about the first flight. Try to answer the questions about the story.

A Famous First Flight

As the sun rose on December 17, 1903, a bitter wind blew about 22 to 27 miles per hour by the fishermen's shanties of Kitty Hawk, North Carolina. Kill Devil Hill, four miles south of Kitty Hawk, was barren and dreary.

By noon that day, in that remote corner of America, two obscure bicycle makers, Orville and Wilbur Wright from Dayton, Ohio, had flown four times in a powered airplane.

They had fitted a biplane with a 16 h.p. motor, which had a total weight of 750 pounds. In the first flight, Orville Wright flew at a speed of 30 to 35 miles per hour. He covered a distance of 120 feet in 12 seconds. Later the same day Wilbur Wright flew the machine a distance of 852 feet in 59 seconds.

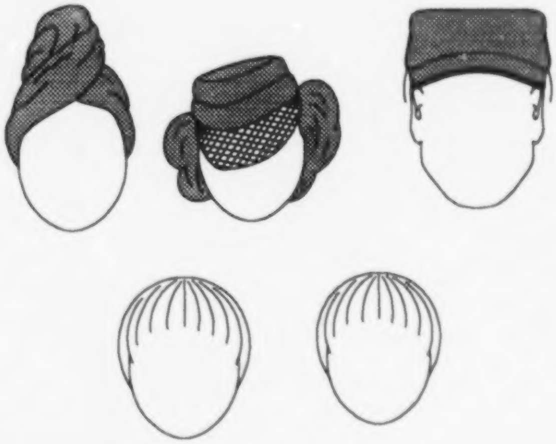
After the last flight was completed, a gust of wind tumbled the machine and damaged it enough to call a halt to the experiments. The Wright brothers packed up and went back to Dayton. They had done something people had been striving towards since recorded history began.

Orville and Wilbur Wright later wrote of that first 12 second flight that it was "the first in the history of the world in which a machine carrying a person had raised itself by its own power into the air in free flight, had sailed forward on a level course without reduction of speed, and had finally landed without being wrecked."

Try to answer the following questions:

1. Who designed and flew the first powered airplane?
2. When did the flight occur?
3. How long did the first flight last?
4. What did the famous brothers do for a living?
5. Where did the flights take place?
6. What distance did the first plane fly?
7. How much did the airplane weigh?
8. Was the airplane damaged that day?

2. Draw some people around the plane. What expression do you think they had on their faces? Do you think the pilots were laughing, smiling, crying, frowning? Draw their faces, too.



THE FIRST FLIGHT for advanced or older learners

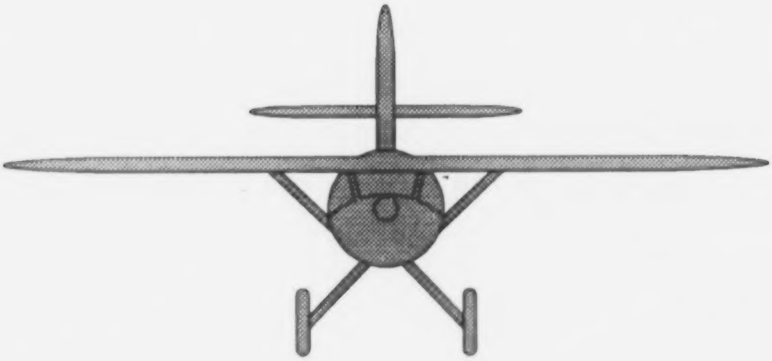
Skill: Increasing science knowledge. Art experience.

Procedure: 1. Discover what happened after the first flight. You might check your library for details. Draw a picture or make a time line, showing how the Orville brothers helped other people learn to fly.

2. Make a model, from a craft show or from library instructions, of the first plane.

Answers to story questions:

1. Orville and Wilbur Wright
2. December 17, 1903
3. 12 seconds
4. They made bicycles.
5. Kitty Hawk, North Carolina
6. 120 feet
7. 750 pounds
8. Yes



FAMOUS AVIATORS

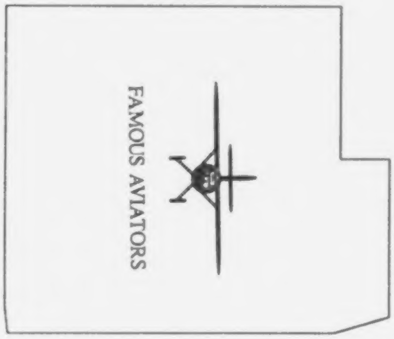
Name: **FAMOUS AVIATORS**

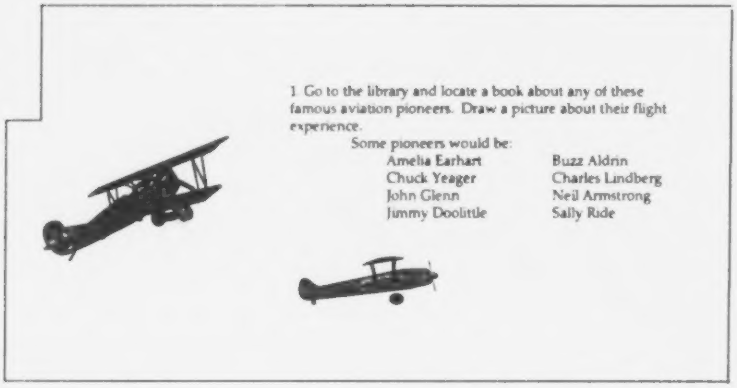
Skill: Reading Comprehension. Art activities.

Procedure: 1. Go to the library and locate a book about any of these famous aviators. Draw a picture about their flight experiences. Some pioneers might be:

Amelia Earhart
Chuck Yeager
John Glenn
Jimmy Doolittle
Buzz Aldrin
Charles Lindberg
Neil Armstrong
Sally Ride

Check your appendix for others.





1 Go to the library and locate a book about any of these famous aviation pioneers. Draw a picture about their flight experience.

Some pioneers would be:

Amelia Earhart
Chuck Yeager
John Glenn
Jimmy Doolittle
Buzz Aldrin
Charles Lindberg
Neil Armstrong
Sally Ride

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- Chuck Yeager
- John Glenn
- Jimmy Doolittle
- Buzz Aldrin
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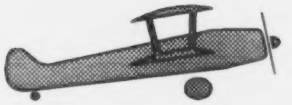
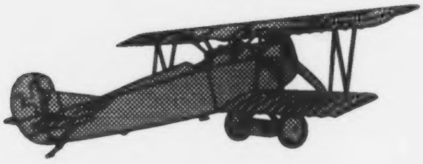
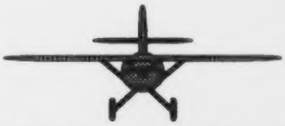
- Neil Armstrong
- Sally Ride







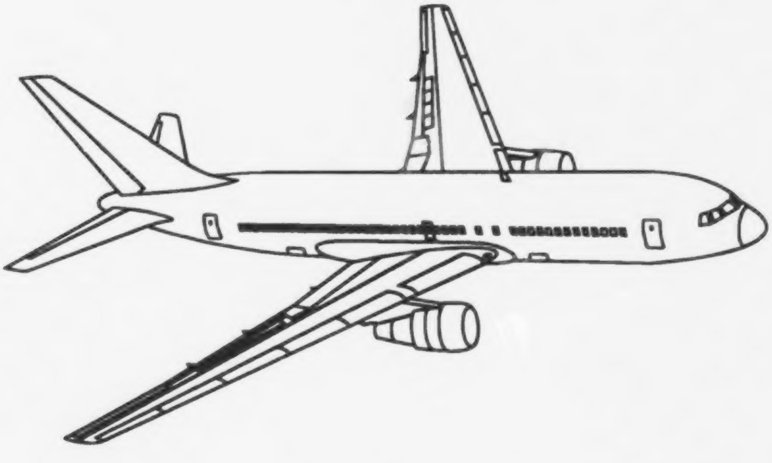
FAMOUS AVIATORS

for advanced or older learners

Skill: Increasing science knowledge about famous flights. Building a bulletin board time line. Art experience.

Procedure: 1. Look in the appendix at the list of famous aviators. Find out when and what they flew. Select several, perhaps 10 to 20, aviators. Make a symbol to represent them (a balloon, a plane, a face...) and construct a bulletin board placing the flights in order of the date they occurred, or whatever strikes you as important about their flight.

AIRPLANE PARTS



Name: **AIRPLANE PARTS**

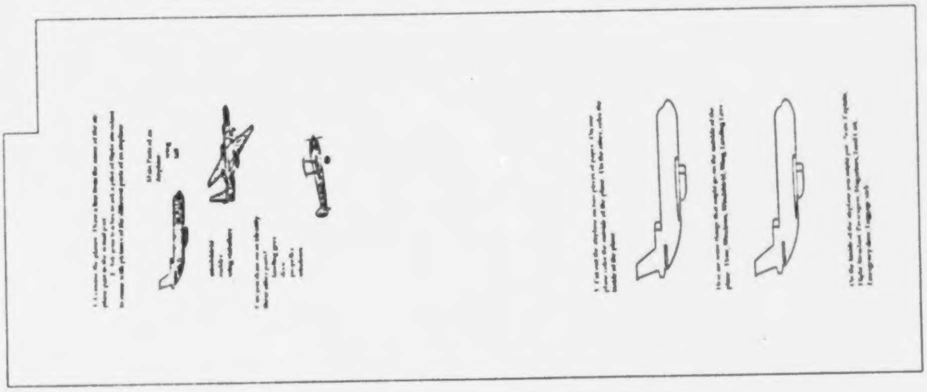
Skill: Parts identification. Art activities.

Procedure: 1. Examine the airplanes. Draw a line from the name of the airplane part to the actual part.

2. Ask your teacher to ask a pilot or flight attendant to visit your class with pictures of the different parts of an airplane.

3. Cut out the airplane on two pieces of paper. On one plane color the outside of the plane. On the other, color the inside of the plane.

AIRPLANE
PARTS



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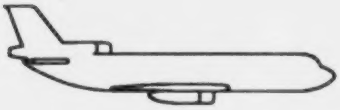
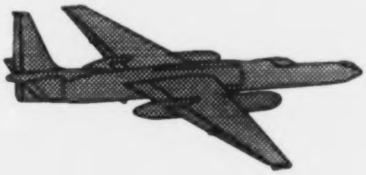
1. Examine the planes. Draw a line from the name of the airplane part to the actual part.

2. Ask your teacher to ask a pilot or flight attendant to come with pictures of the different parts of an airplane.

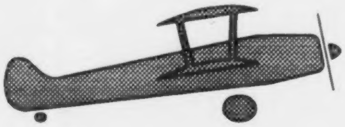


Main Parts of an Airplane:
- wing
- tail

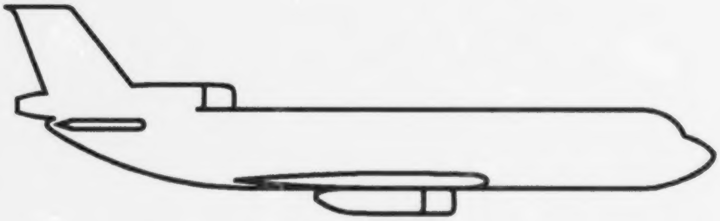
- windshield
- rudder
- wing stabalizer



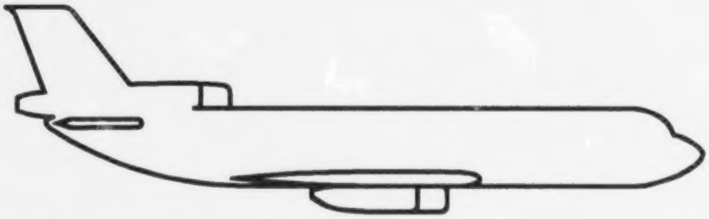
Can you draw on or identify these other parts?
- landing gear
- door
- propeller
- windows



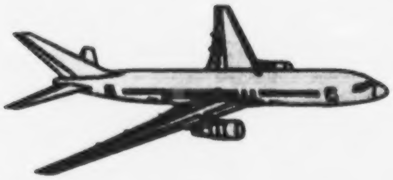
3. Cut out the airplane on two pieces of paper. Color the outside of one plane. Color the inside of the other plane.



Here are some things that might go on the outside of the plane: door, windows, windshield, landing gear, wing . . .



On the inside of the airplane you might put: seats, captain, flight attendant, passengers, magazines, food cart, emergency door, luggage rack . . .



AIRPLANE PARTS for advanced or older learners

Skill: Vocabulary building. Library research.

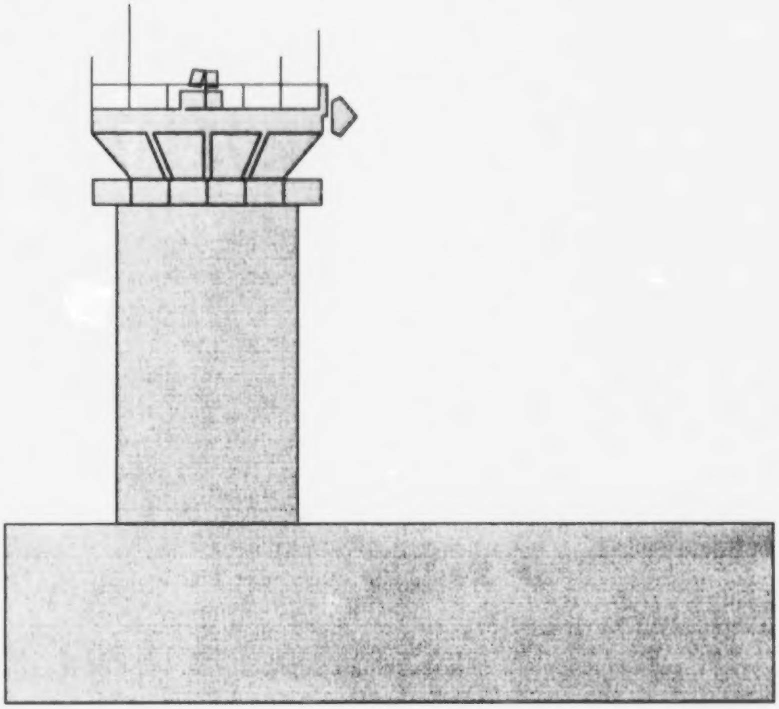
Procedure: 1. Look in the library for a book on airplanes, or search in an encyclopedia or dictionary for the following parts of an airplane.

wing strut,
fuselage,
rudder,
port wing,
flap,
engine cowl.

Can you draw any of these things on a plane?

2. Visit your local airport to see the cockpit and the other parts of an airplane first-hand.

The Airport



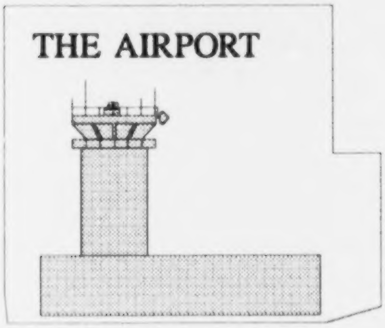
Name: **THE AIRPORT**

Skill: Object Identification. Art activities. Learning about the airport.

Procedure: 1. Think of all the things that you find at the airport. What do they do? What are they there for? Look up *airport* in a book or encyclopedia to learn about the things at an airport you are unfamiliar with.

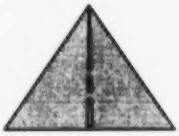
2. Pilots have to drive the airplane a certain way, just like cars have to drive in a certain lane and stop at red lights. Examine the ways and places a pilot can drive the plane.

3. People who ride airplanes have to follow a time schedule and gate schedule so they know when their plane leaves and from which gate in the airport. Look at the schedule and see if you could get on the plane you wanted.

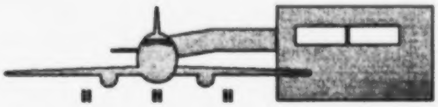


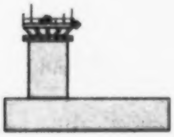
1. Think of all the things that you find at the airport. What do they do? What are they there for? Look up airport in a book or encyclopedia to learn about the things at an airport you are unfamiliar with.

runway, the road from the land to the sky



gate, where passengers enter and exit the airplane





tower, directing the airplanes' flight patterns

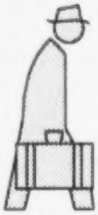
luggage cart, taking your bag to your plane

directional arrows, for the plane to know where to go

luggage tags, so your name is on your bag

captain, the person who drives the airplane

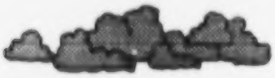
passengers, finding the plane they want to take

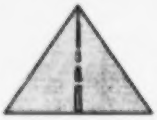


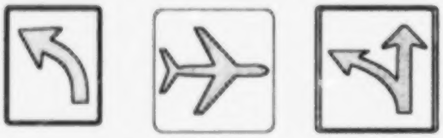
And how about these things: do you know what they are, where they are, or what they are used for?

PARKING LOT
ESCALATOR
HANGER
WAITING AREA
TICKET COUNTER
SNACKS AND MAGAZINES

2. Pilots have to drive the airplane a certain way, just like cars have to drive in a certain lane and stop at a red light. Look over the ways and places a pilot can drive the plane.







Your teacher might ask a pilot to visit and talk about how flying a plane is like driving a car.

3. People who ride airplanes have to follow a time schedule and gate schedule so they know then their plane leaves and from what gate in the airport. Look at the schedule and see if you could get on the plane you wanted.

A flight schedule when you are leaving from your city might look something like this:

Destination	gate	depaarture time	arrival time
Atlanta	C-7	4:30 PM	5:45 PM
Boston	B-6	9:40 AM	11:00 AM
Denver	A-11	8:20 AM	4:55 PM
New York	B-2	6:00 PM	9:00 PM
San Diego	B-21	11:15 PM	6:30 AM

Your teacher might act as a travel agent to plan how you could go see a person in another city. Where would you like to go?

THE AIRPORT for advanced or older learners

Skill: Vocabulary building. Library research.

Procedure: 1. Look in the library or go to the airport and see first hand what the following things are. Make a note of their color and size, meaning, or function:

hanger
air traffic controller
taxi
air traffic patterns

2. Call a travel agent and find out how to visit your friend, grandmother, or relative in another city fairly far away from your house by riding an airplane. Take note of:

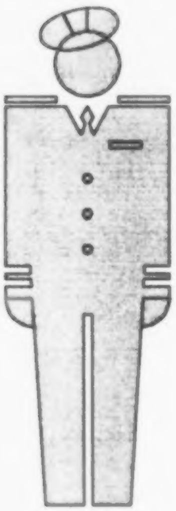
the name of the airline,
when the plane departs from your city,
what time you should arrive at the airport
    to be on your plane on time,
how long you will be flying,
how much the ticket costs,
how many days you are visiting,
and, what time your plane lands in
    the other city.

Name: **AVIATION CAREERS**

Skill: Career awareness. Vocabulary building.

Procedure: 1. Match the career with what the person does in their job. Cut out each card with the name and each card with the job description. Try to match them. After you learn them, turn them over and play a game with a friend of finding the correct match between career title and career duties.

2. Your teacher might ask any of these people to come speak to your class. If one of your parents does one of these jobs, tell your teacher so that your parent can visit the class to tell about his work.



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Aircraft Engine Mechanic	Checks the engine and instruments to see if they work properly on the plane.
Airline Worker at the Ticket Counter	Sells you your ticket, gives you a boarding pass, checks your baggage.
Air Route Traffic Controller	Watches the plane on the radar screen, and tells the pilot where to fly along the airways.
Cargo Loader	Puts the baggage, mail, and supplies on board the plane.

Co-pilot	Sits in the cockpit with the pilot and helps fly the plane.
Flight Attendant	Works in the passenger cabin making sure that everyone is comfortable. Serves drinks and meals. Helps passengers find their seats and fasten their seatbelts, and demonstrates emergency procedures.
Flight Dispatcher	Helps the pilot plan the flight.
Flight Engineer	Checks the equipment and makes sure it operates properly during flights. Sits in the cockpit behind the pilots.
Flight Service Specialist	Talks to the pilot and gives weather and flying information, and helps plan the flight.

Ground Controller	Controls the airplane on the ground. Tells the pilot where to taxi.
Ground Crew	Puts fuel in the plane, and also tells the pilot where to park the plane. Helps the passengers get off the plane.
Pilot	Sits in the cockpit and flys the plane. Studies weather maps and files flight plans.
Porter	Helps the passengers carry their baggage to the terminal.
Tower Air Traffic Specialist	Gives the pilot permission to take off and land; communicates on a two-way radio. Controls traffic.

AVIATION CAREERS

for advanced or older learners

Skill: Vocabulary building. Library research. Art activity.

Procedure: 1. Look in the library or contact an airline and determine the uniform that each of these careers demands. Draw or use construction paper to create a likeness of each person. You can put them on a bulletin board or make a folder or sales catalog.

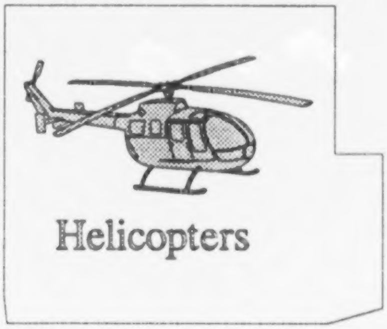
Helicopters

Name: **HELICOPTERS**

Skill: Reading Comprehension. Art Activity.

Procedure: 1. Read the history of the helicopter and answer the questions. Check your answers with the key.

2. Your teacher might ask a local pilot from a television station or radio weather patrol, or a local amateur helicopter pilot to come speak to the class. Perhaps he or she could park their helicopter on the playground or parking lot.



1. Read the story about the helicopter and answer the questions. Check your answers with the key.

THE ALL-PURPOSE HELICOPTER

The helicopter was thought of hundreds of years ago. The Chinese made toys out of flying tops with feather rotors. Leonardo daVinci (1452 - 1519), great Italian artist and scientist, drew sketches of a similar flying machine.

Igor I. Sikorsky built the first practical single-rotor helicopter in 1939 and flew it in 1940. He was a Russian engineer who came to this country in 1919. The United States government used many Sikorsky helicopters for its armed forces.

The helicopter is an aircraft which can do all kinds of tricks as well as be an excellent worker. It can go straight up and down, make vertical takeoffs and landings, fly forward, backward, or sideways. It can turn around completely, and it can even stay in one spot in the air.

It has several nicknames, such as "whirlybird," "eggbeater," and "chopper." There is a large, horizontal propeller above the helicopter's body called a *rotor,* which spins and makes the helicopter fly.

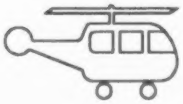
The helicopter can do jobs that no other vehicle can do on land, air, or sea. It can speed travelers from a downtown heliport to an airport at the edge of a city. It can hover in the air while its crew lifts a shipwreck victim or a stranded mountain climber to safety. It is used for many rescue missions from accident to hospital, for reporting traffic congestion on highways, for police detective work, and for dropping food, clothing, and medical aid to victims of floods and disasters. They can carry from one to thirty passengers.

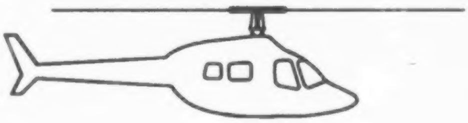
Now, answer these questions about the story. Check your answers with the key.

1. What directions can a helicopter fly?
2. The whirling blade on the top of a helicopter is called a ...?
3. What can a helicopter be used for?
4. Other names for this flying machine are ...?

Key: 1. Vertically, backwards, forward, sideways. 2. rotor. 3. Lifts shipwreck victims and stranded mountain climbers to safety; rushes accident victims to hospitals; used in reporting traffic conditions; drops food and supplies to disaster victims; military and business purposes. 4. whirlybird, eggbeater, chopper.

Color these helicopters, and cut them out for display, or make one from construction paper and mount it on a popscicle stick.





HELICOPTER for advanced or older learners

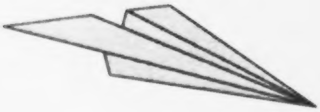
Skill: Library research. Art activity.

Procedure: 1. Look in the library or contact a local small airport and ask for drawings of helicopters and procedures for landing and flying.

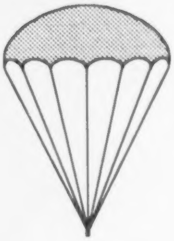
2. From the library or a craft store, build your own helicopter.

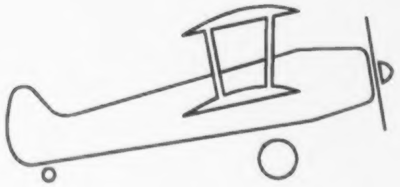
3. From the library or encyclopedia, find out what things in nature act like helicopters; what seeds, natural elements, etc., offer the principles of a helicopter like:

flying sideways, up and down
hovering
using a rotor
or just by appearance.



AIRCRAFT COLLAGE



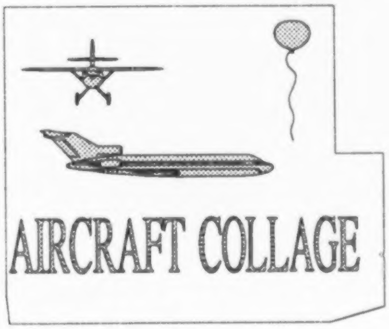


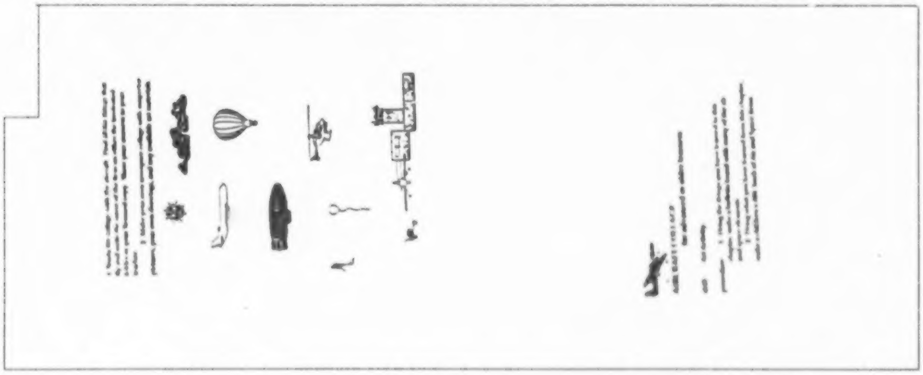
Name: **AIRCRAFT COLLAGE**

Skill: Visual awareness. Art activity.

Procedure: 1. Study the collage of the aircraft. Find all the things that fly and write the name of the item on either the laminated folder or your duplicated copy. Show your answers to your teacher.

2. Make your own aerospace collage with magazine pictures, your own drawings, and any available art materials.





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1. Study the collage with the aircraft. Find all the things that fly and write the name of the item on either the laminated folder or your duplicated copy. Show your answers to your teacher.

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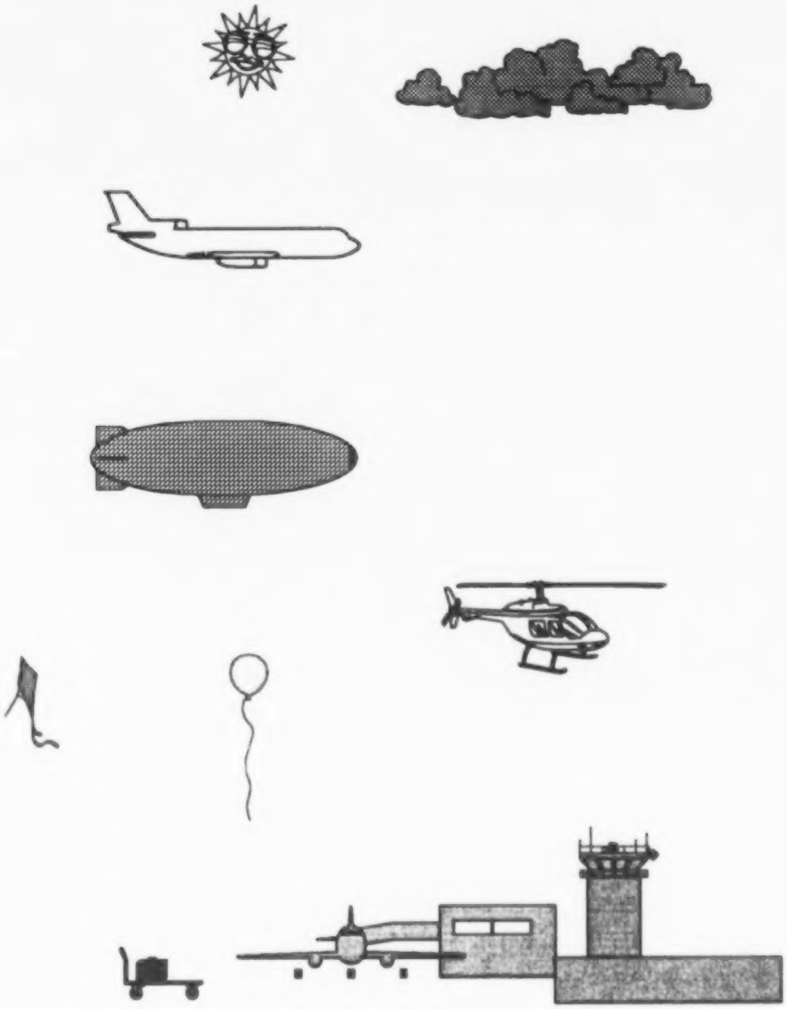


AIRCRAFT COLLAGE

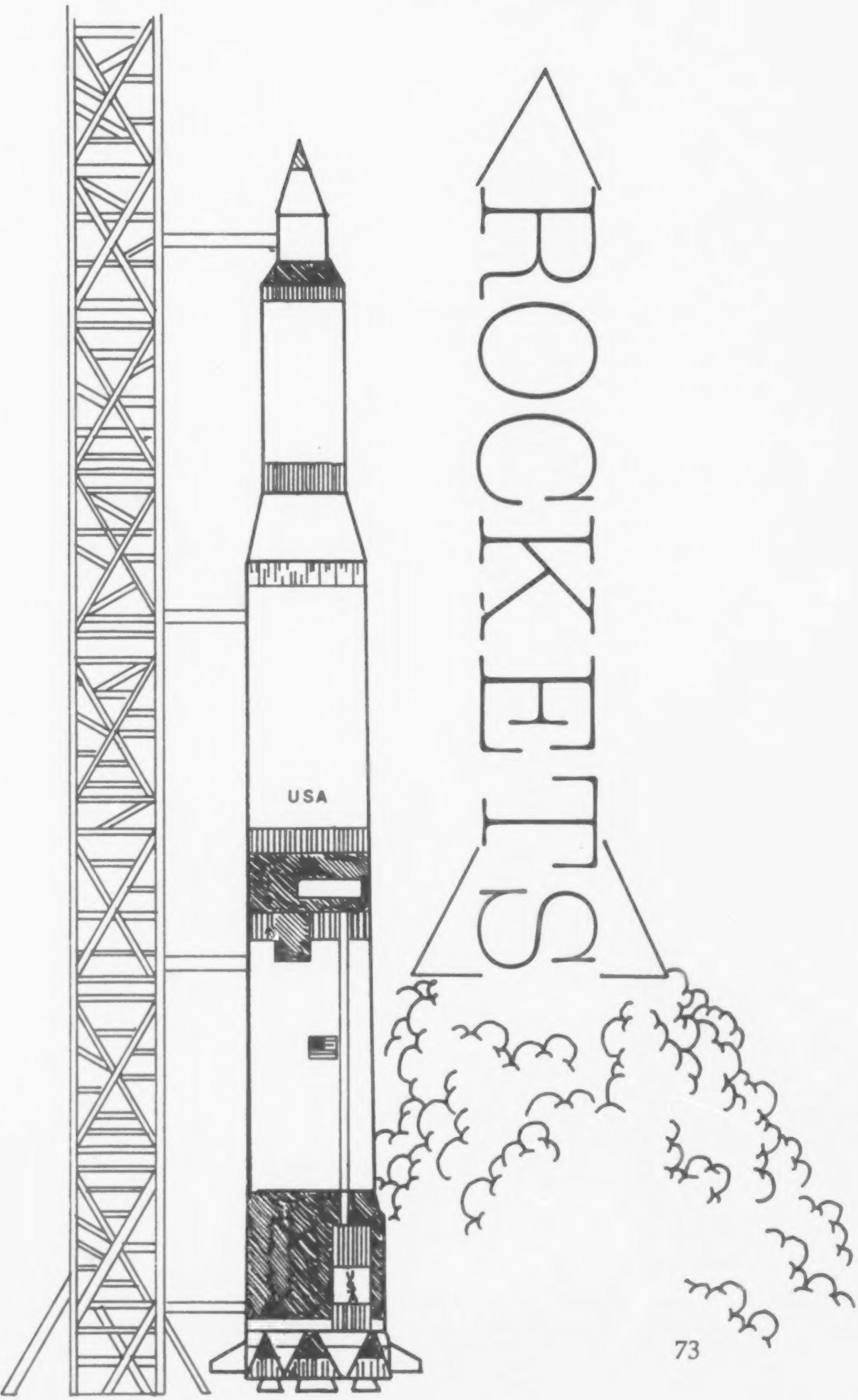
for advanced or older learners

Skill: Art activity.

Procedure: 1. Using the things you have learned in this chapter, make a bulletin board with many of the air and space elements.

2. Using what you have learned from this chapter, make a children's ABC book of air and space items.

SPACE *beyond* THE EARTH


ROCKETS
USA

Name: **ROCKETS**

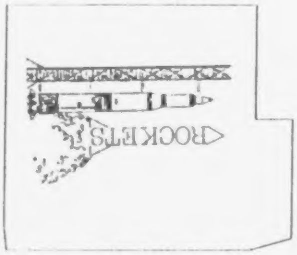
Skill: Art and Sequencing activity.

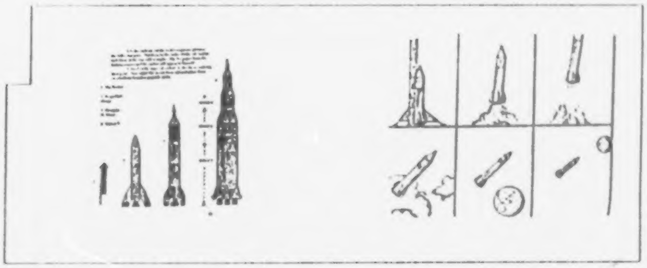
Procedure: 1. Color and cut out the rocket sequence pictures. Put them in the order of take-off, and attach them at the top with a stapler. Flip the pages from the bottom corner and the rocket will appear to take off.

2. Look at the types of rockets. Color them, noticing their parts. You might like to cut them out and place them on a bulletin board or popsicle sticks.

3. Read about how rockets operate. See this demonstrated by using a balloon to act as a rocket.

4. Enjoy singing or reciting the rhymes about rockets aloud.





1. Color and cut out the rocket sequence pictures on the following page. Put them in the order of take-off, and attach them at the top with a stapler. Flip the pages from the bottom corner and the rocket will appear to launch!

2. Look at the types of rockets. Color them, noticing their parts. You might like to cut them out and place them on a bulletin board or popsicle sticks.

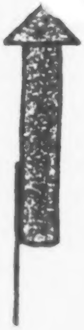
1. Sky Rocket

2. Propellant charge

3. Mercury-Redstone

4. Saturn V

1



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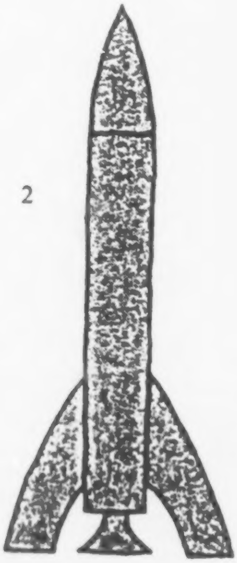

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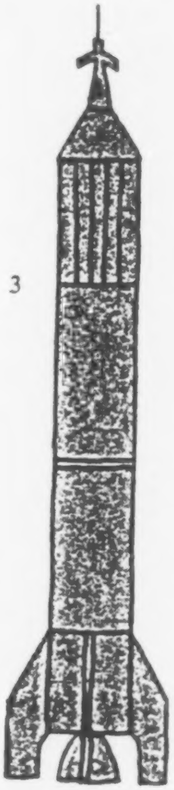

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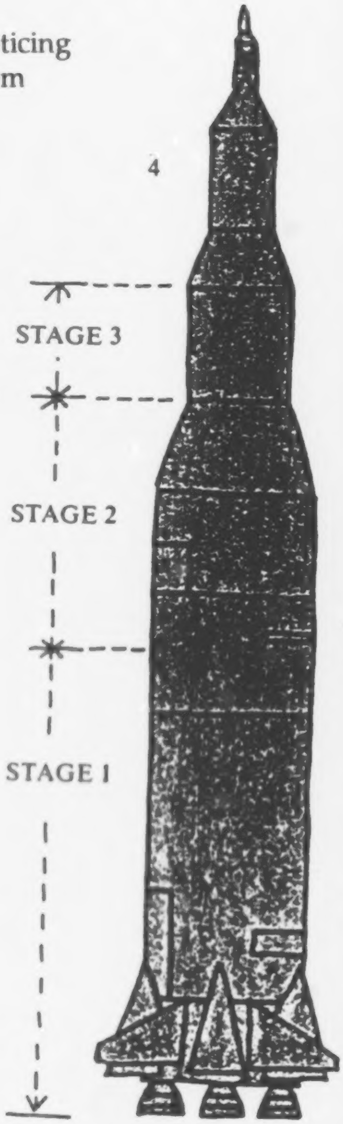
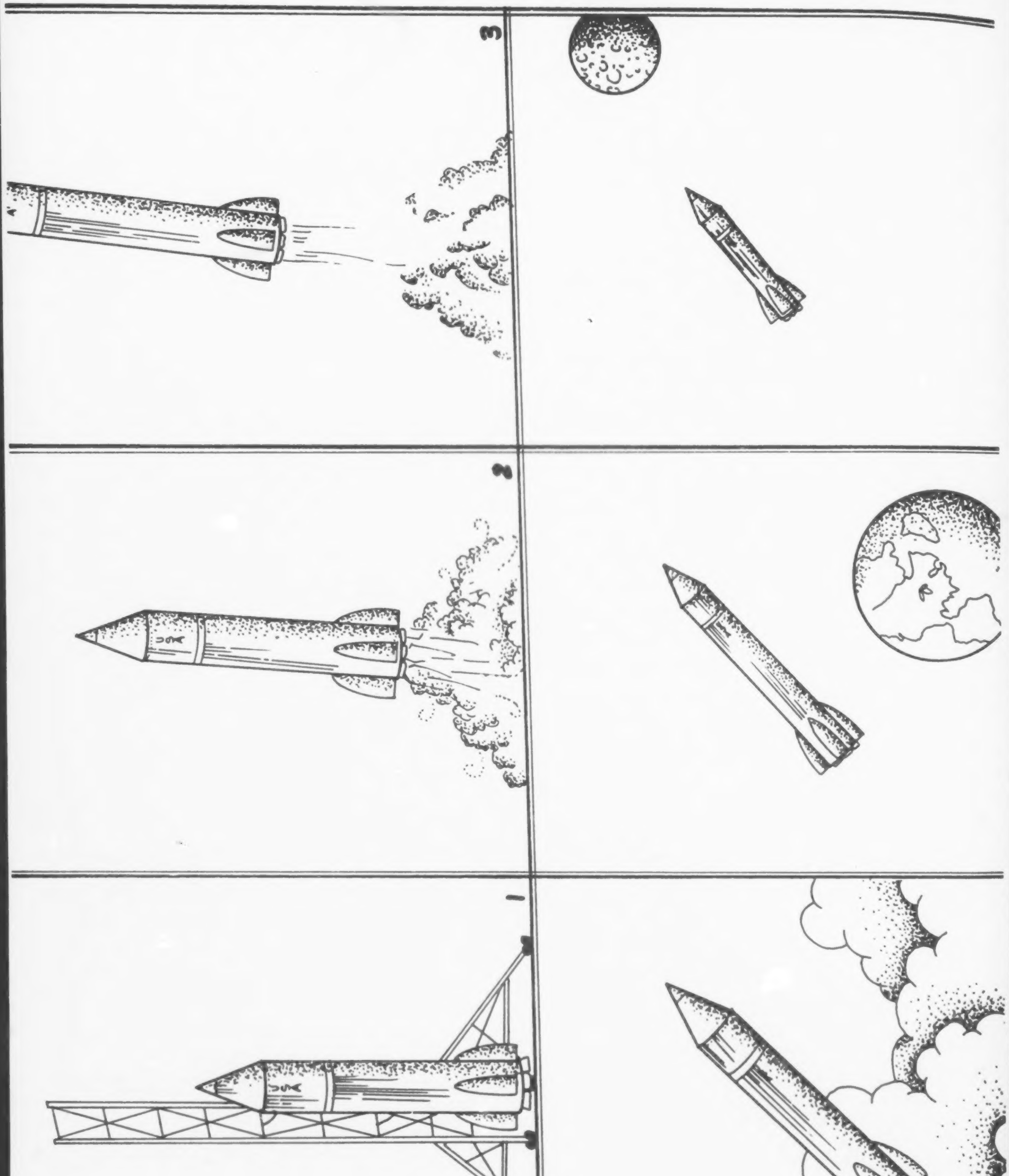



3
2
1
USA

3. Read about how rockets work. See this demonstrated by using a balloon to act as a rocket.

Rockets use motion to launch into the sky. There is motion from the rocket pushing against the ground, and a resulting motion of the rocket rising off the ground and away from the earth. The rocket fuel creates the motion that pushes the rocket upward.

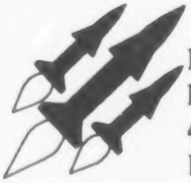
The simplest way you can see how a rocket works is to make a balloon act like a rocket: You inflate the balloon, giving it the "fuel" to take-off, and then you let go of the balloon, seeing it soar through the air.

This is called Newton's Third Law of Motion: for every action there is an equal and opposite reaction. Or, for each motion there is an opposite motion: when the air comes out of the balloon, the balloon goes forward. When the fuel discharges from the rocket, the rocket moves up.

4. Enjoy singing or reciting the rhymes about rockets aloud.

DID YOU EVER SEE A ROCKET?
(to the tune of "Did You Ever See a Lassie?")
Did you ever see a rocket, a rocket, a rocket?
Did you ever see a rocket go this way and that?
Go this way and that way, go this way and that way,
Did you ever see a rocket go this way and that?
(repeat using other aerospace items)

I'M A ROCKET!



I'm a little rocket	(Child crouches on heels)
Pointing to the moon	(Child points upward)
4. . . . 3. . . . 2. . . . 1. . .	(Said slowly)
Blast Off! ZOOM!	(Springs up and jumps in the air)

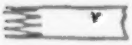
ROCKETS for advanced or older learners

Skill: Art activity. Fine motor skills. Following directions.

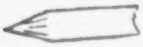
Procedure: 1. Make your own rocket! You'll need: Empty cardboard cylinders, Rolled up paper, Tape, Paint, and any other things you'd like to include. Study the pictures of the rockets and design your own!

a. Cut a strip of paper 8 inches long and 2 inches wide.

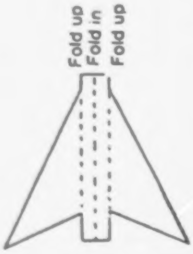
b. Roll the paper strip around the pencil and tape the ends together. The paper tube should slide easily off the pencil but not be too loose.



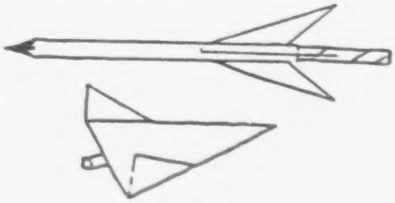
c. Make several pointed cuts at one end of the tube.

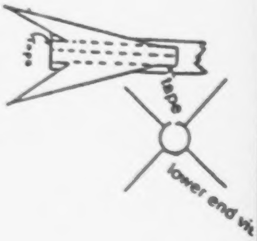


d. Slide the sharpened end of the pencil toward the pointed cuts. Fold the points around the sharpened end of the pencil and tape to form the nose cone.



e. Cut out two sets of fins, using the pattern here. Fold the fins on the dashed lines.



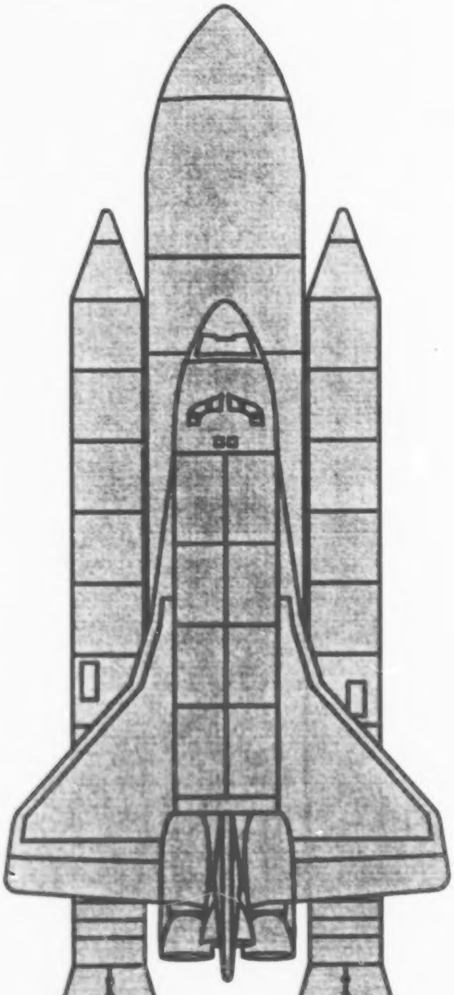


f. Using two pieces of tape, fix the fins to the opposite end of the tube from the nose cone. Insert pencil for support in taping.

g. Place the rocket over the soda straw. Launch, where you will hit no one, by blowing sharply on the straw.

--Gregory L. Vogt

Space Shuttle



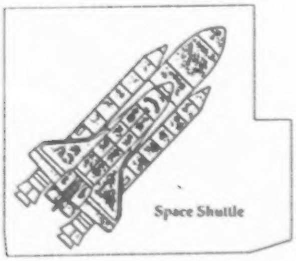
Name: **SPACE SHUTTLE**

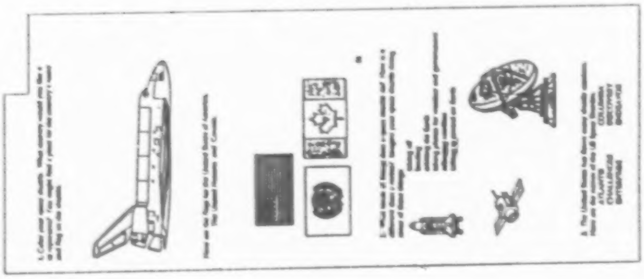
Skill: Art and Science activities.

Procedure: 1. Color your space shuttle. What country would you like it to represent? You might find a place for the country's name and flag on the shuttle.

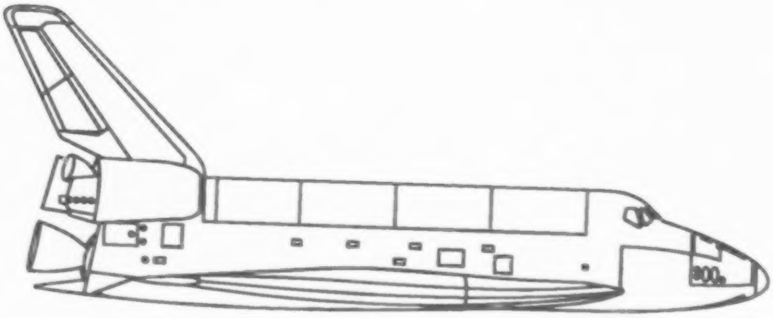
2. What kinds of things does a space shuttle do? How is it different than a rocket? Imagine your space shuttle doing some of these things:

3. The United States has flown many shuttle missions. Here are the names of the US Space Shuttles.

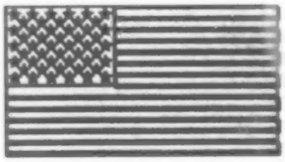


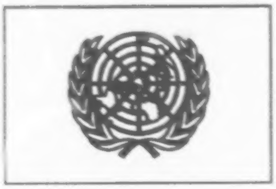


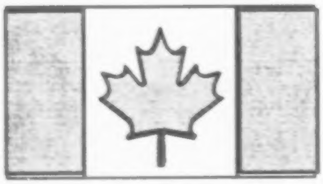
1. Color your space shuttle. What country would you like it to represent? You might find a place for the country's name and flag on the shuttle.



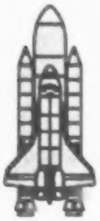
Here are the flags for the United States of America,
The United Nations and Canada.



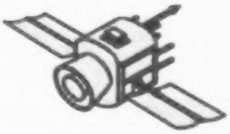


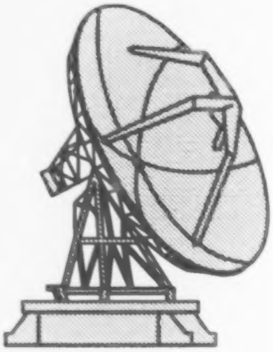


2. What kinds of things does a space shuttle do? How is it different than a rocket? Imagine your space shuttle doing some of these things:



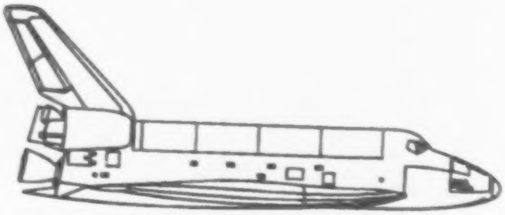
taking off
landing
orbiting the Earth
taking photos for weather and government
adjusting satellites
talking to the control station on Earth

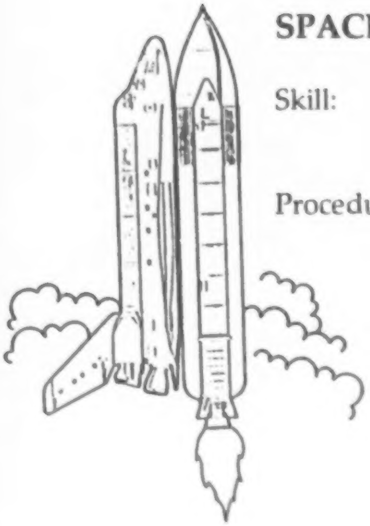




3. The United States has flown many shuttle missions. Here are the names of the US Space Shuttles.

ATLANTIS
CHALLENGER
ENTERPRISE
COLUMBIA
DISCOVERY
ENDEAVOR



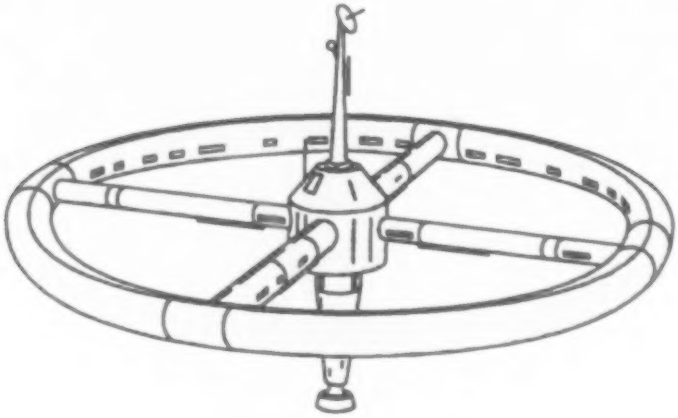


SPACE SHUTTLE for advanced or older learners

Skill: Art activity and fine motor skills.
Following directions. Library interaction.

Procedure: 1. Read more about each shuttle mission: Try to find out if there were delays, disappointments, successful maneuvers, deaths, people other than astronauts aboard . . . . You might write or draw about what you find out. You might see who benefits more often from shuttle experiments: science, government, private companies, or education.

SPACE



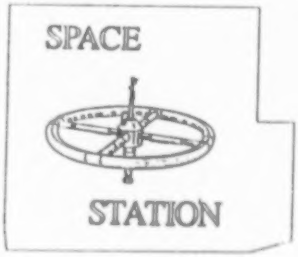
STATION

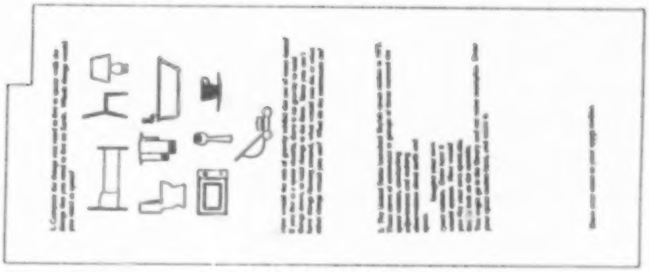
Name: **SPACE STATION**

Skill: Item identification. Art and Imagination activities.

Procedure: 1. Compare the things you need to live in space with the things that you need to live on Earth. How would the lack of gravity inhibit the use of some items?

2. Imagine your own space station. Draw how it would appear.





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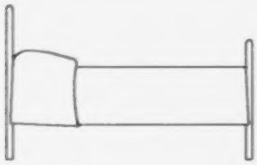
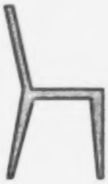
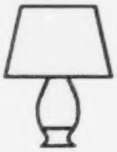
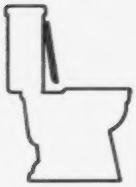
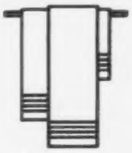
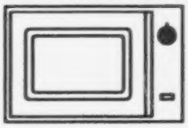
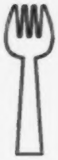
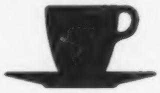
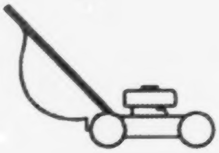
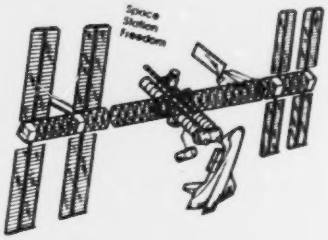
1. Compare the things you need to live in space with the things that you need to live on Earth. Which things would you need in space?

How would the lack of gravity inhibit the use of some items? If you live in a space shuttle, there is no gravity to hold things down. Since you can't have things floating around, what would you do, or what other things would you use? What do the astronauts do?

2. The United States launched Skylab space station in 1973. Three crews of astronauts manned the space station, conducting experiments and making observations about earth and space.



Imagine your own space station. Draw how it would appear. How would you like your own space station to look on the outside. You might go to the library and see some examples. Draw your space station here, and name it.

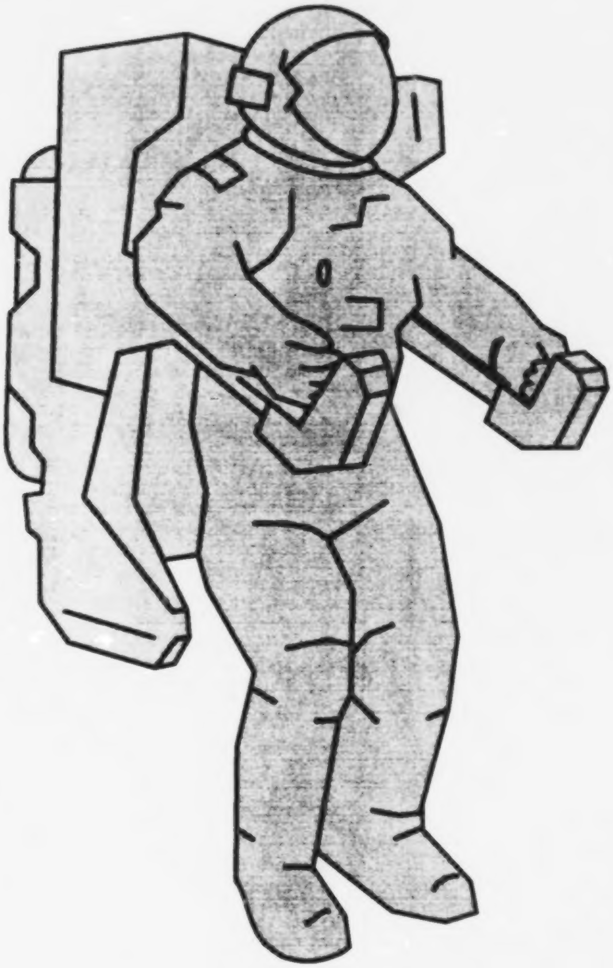
Draw your own room in your space station.

SPACE STATION for advanced or older learners

Skill: Art and Research skills. Imagination activity.

Procedure: 1. Look up space stations in your library. Using the photographs, diagrams, and descriptions, design your own space station. Use your imagination! Mail your idea to NASA (see appendix for address), or make a model or bulletin board.

Astronaut



Name: **ASTRONAUT**

Skill: Vocabulary and Art activities. Poetry Reading and Play-acting.

Procedure: 1. Learn the poems about astronauts. Teach them to a friend or act them out with the astronauts you make yourself.

2. Pretend you are an astronaut landing on the moon. Use your imagination.

3. Color and cut out the astronauts. Attach them to popsicle sticks, and use them to act out landing on the moon, the poems you have to read, or your own stories, poems, and songs.

Variations: Tips for teachers: Assist your students in play-acting by providing equipment for the rocket and suits: Large milk jugs for helmets; foil, sweats, or aprons for suits; painted boxes as oxygen tanks; other play items could be Poptarts for non-perishable foods, Refrigerator boxes for spaceships and moonlanders, and the classroom making the sound effects for the actors.

One day children could dress fancifully and use the playground for the moon. Their imagination with your help could lead to moon monsters, aliens, astronauts from other countries. . . and all kinds of adventures.

Also, another time a moon landscape could be designed using a sand table. Purchase small toys and space ships for the children to enact pretend landings on the moon.

1. Learn the poems about astronauts. Teach them to a friend or act them out with the astronauts you make yourself.

sing to the tune "Ten Little Indians:"

Ten Little Astronauts

One little, two little, three little astronauts,
Four little, five little, six little astronauts,
Seven little, eight little, nine little astronauts,
Ten little AS - TRO - NAUTS!

Two Little Astronauts

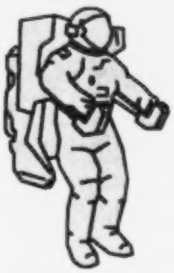
Two Little astronauts are going to the moon,
Two little astronauts hope they'll get there soon,
The first one said, "Oh, this is such fun!"
The second one said, "We will see the sun!"
Then -- 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, ***ZOOM!***

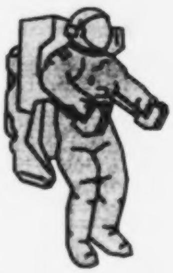
2. Pretend you are an astronaut landing on the moon. Use your imagination.

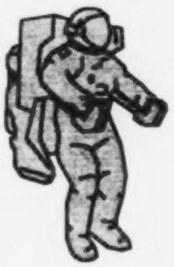
You can act out the poems. You might use a table, large blocks, chairs, or anything you like to be the space ship or rocket. You can use sweat suits or aprons, anything you see, for astronaut suits, and boxes or plastic for boots.

Apollo 11 succeeded in President John F. Kennedy's goals for America: to land men on the moon and return them to earth safely. Only July 16, 1961 the mission was launched by a Saturn rocket, and on July 20, Neil Armstrong stepped onto the moon's surface. Along with Edwin Aldrin Jr., Armstrong collected samples of the moon's soil and rocks and took motion and still pictures. This was an historic event. The mission lasted eight days.

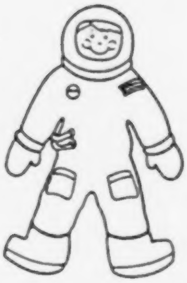
3. Color and cut out the astronauts. Attach them to popsicle sticks, and use them to act out landing on the moon, or the poems you have to read, or your own stories, poems and songs.

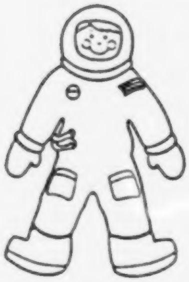


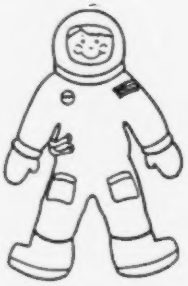




Also, you can take one or more of these astronauts and draw the moon, the space ship that brought them there, and the craters, and then paste the astronauts onto your picture.







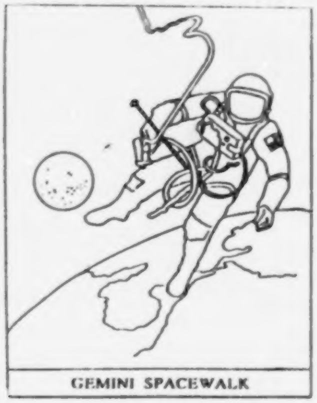
ASTRONAUTS for advanced or older learners

Skill: Art and Research skills.

Procedure: 1. Make a shadow box moonscape. Use the astronauts with a lunar landing module for a moonscape model. Check your library for books with pictures, or ask your teacher for examples.

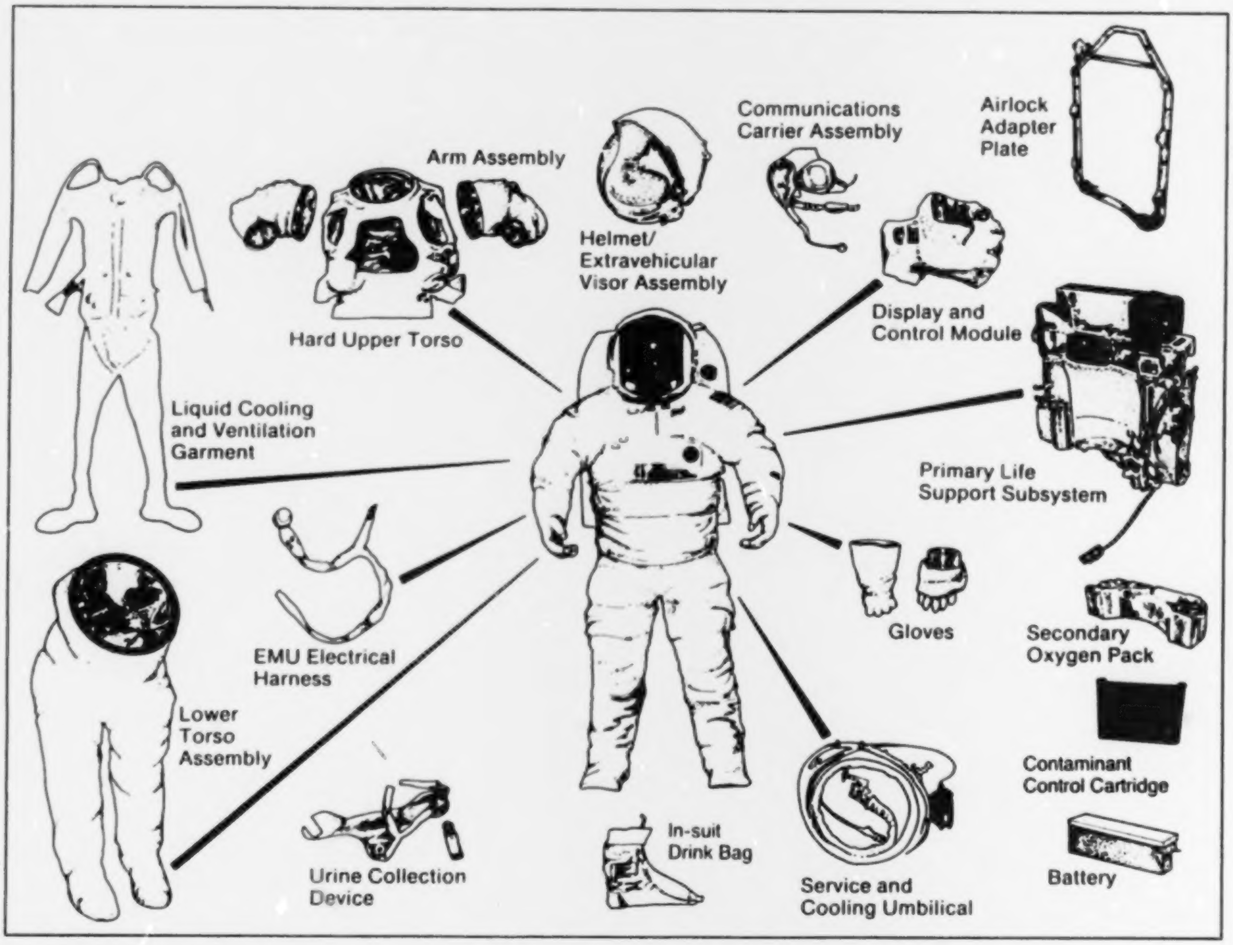
2. Read about the Eagle and astronauts Neil Armstrong and Buzz Aldrin, the first men on the moon.

3. Read about Col. Fredrick D. Gregory, space shuttle pilot. Check your library for these things.



GEMINI SPACEWALK

Space Suits


Communications Carrier Assembly
Airlock Adapter Plate
Arm Assembly
Helmet/ Extravehicular Visor Assembly
Display and Control Module
Hard Upper Torso
Liquid Cooling and Ventilation Garment
Primary Life Support Subsystem
EMU Electrical Harness
Gloves
Secondary Oxygen Pack
Lower Torso Assembly
Contaminant Control Cartridge
In-suit Drink Bag
Urine Collection Device
Service and Cooling Umbilical
Battery

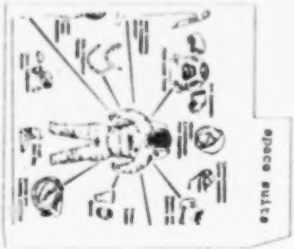
Space shuttle EMU components

Name: **SPACE SUITS**

Skill: Vocabulary and Sequencing activities.

Procedure: 1. Read about the special clothes astronauts wear when they are in space. Can you think of things you wear for special situations, like taking off in a rocket?

2. Notice the order in which the astronauts get dressed. Think about what you put on first, second, third, etc. until you are all dressed for school.



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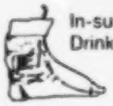
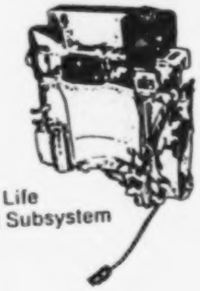
1. Read about the special clothes astronauts wear when they are in space.

Because the air in space is so different than the air on earth, an astronaut must put on a special suit to wear in the space station, in space, or on the moon. Space suits have advanced, and different suits are used for different jobs. For example, when astronauts are being launched into space, they wear a suit that has a parachute and inflates like a life-preserver, in case of an accident. All of the suits are flame resistant, and all have pockets that close with zippers or velcro to carry pens, data books, glasses, and a Swiss army pocketknife, along with other things. Different boots are used to walk on the moon than to work outside the shuttle to fix a broken camera or electronic arm, for example. Usually a camera is attached to the space suit for recording data and history, and for the astronauts inside the shuttle to observe, assist, and record. Usually, space suits have a radio to talk to the shuttle and ground control, and to record the astronauts' pulse and heartbeat. Space suits must keep the astronaut safe from the temperature extremes of space, the lack of oxygen, and any foreign objects. The space station is pressurized like an airplane, so the astronauts wear a more comfortable outfit working on experiments there. The space suit provides for comfortable temperatures, good air to breath, a bathroom, something to drink, and the ability to maneuver in space.



In-suit Drink Bag

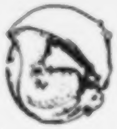


Primary Life Support Subsystem

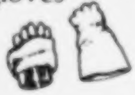
After reading about the special suits that astronauts wear to orbit earth, walk on the moon, or conduct experiments in the space shuttle, can you think of any special "suit" or pieces of suits that you wear to do special activities? For example:

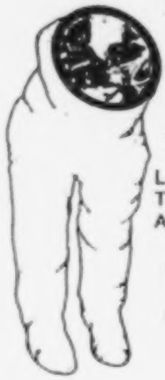
astronaut **you**

helmet



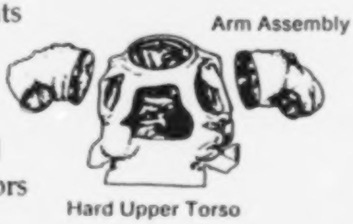
gloves





insulated pants

hard arm and
chest protectors



2. Notice the order in which the astronauts get dressed. Think about what you put on first, second, third, etc. until you are all dressed for school.

astronaut **you**

1. insulated pants
(lower torso assembly)
2. hard body assembly
(upper torso and arm assembly)
3. gloves

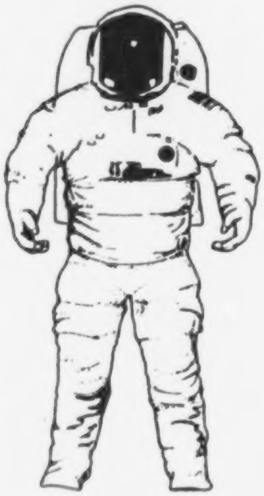
4. helmet

SPACE SUITS for advanced or older learners

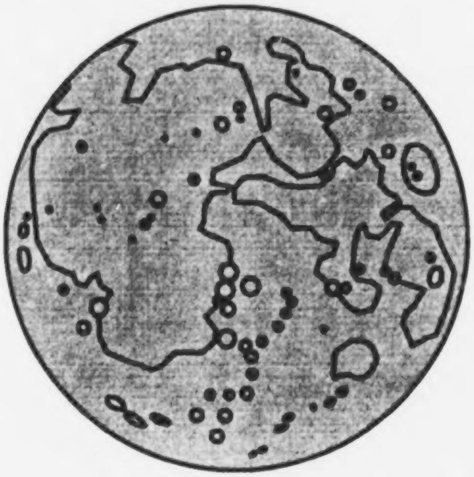
Skill: Research, Art, and Imagination activities.

Procedure: 1. Design your own space suit. Remember all the vital parts!

2. Write NASA for illustrations of real space suits. Also, find out what kind of fabric these suits are made of.



A Trip to the Moon!



Name: **TRIP TO THE MOON**

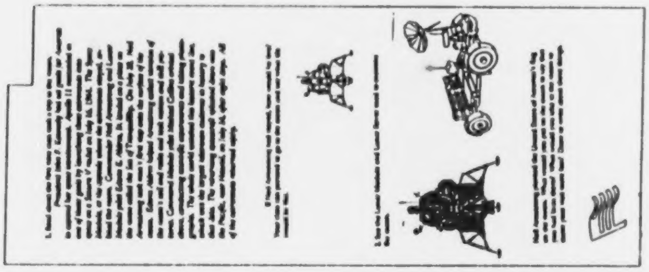
Skill: Reading and Art activities. Group Teamwork exercise.

Procedure: 1. Read about the first time that man took a trip to the moon. If he had stayed, how would he live? Your class can pretend to go to the moon and see what life would be like.

2. See the Lunar Module and Lunar Rover used to examine the moon. Neil Armstrong planted the United States of America's flag on the moon. Think about what you might take to the moon.

Variation: Teachers may elect to use the Moon Survival project in the appendix for their advanced students.

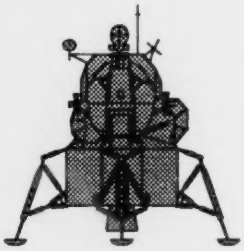
trip to the moon!



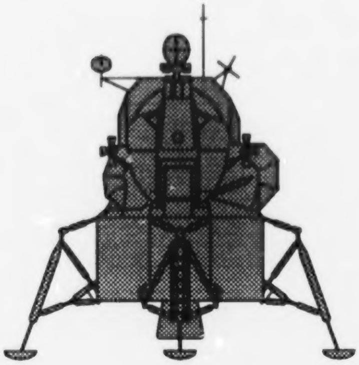
1. Read about the first time man took a trip to the moon.

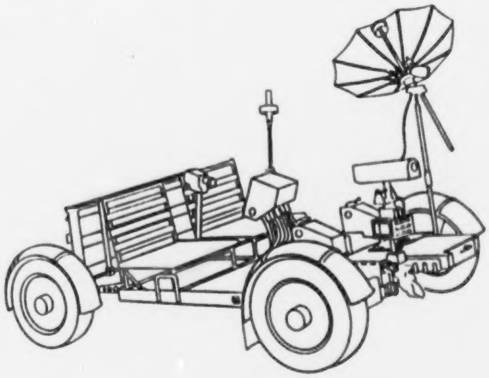
President John F. Kennedy had set goals for America to expand her space involvement. Apollo 11 succeeded in one of those goals by launching three astronauts into space on a Saturn V rocket on July 16, 1969. The Space Module, or the capsule where the astronauts stayed, orbited the moon. Commander Neil Armstrong and Lunar Module pilot Edwin E. Aldrin, Jr. landed on a place on the moon called the Sea of Tranquillity. On July 20, Neil Armstrong took man's first step onto the surface of the moon. Edwin Aldrin helped Armstrong collect samples of the moon's soil and rocks and took motion and still pictures. Command Module pilot Michael Collins orbited above, conducting scientific experiments and taking photographs. The whole world watched this historic event live, which had the largest television audience in history to that date. The returning spacecraft splashed down into the Pacific, near Hawaii, on July 24, after eight days. All of the astronauts returned safely.

If Neil Armstrong had stayed, how would he have lived? Your class can pretend to go to the moon and see what life would be like.

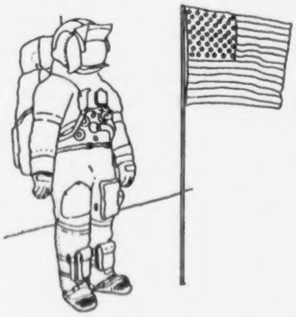


2. See the Lunar Module and Lunar Rover used to explore the moon.





Neil Armstrong planted the United States of America's flag on the moon. What would you put on the moon to say that you had been there? What would you take to the moon to make your visit more fun? Draw or write about these things.



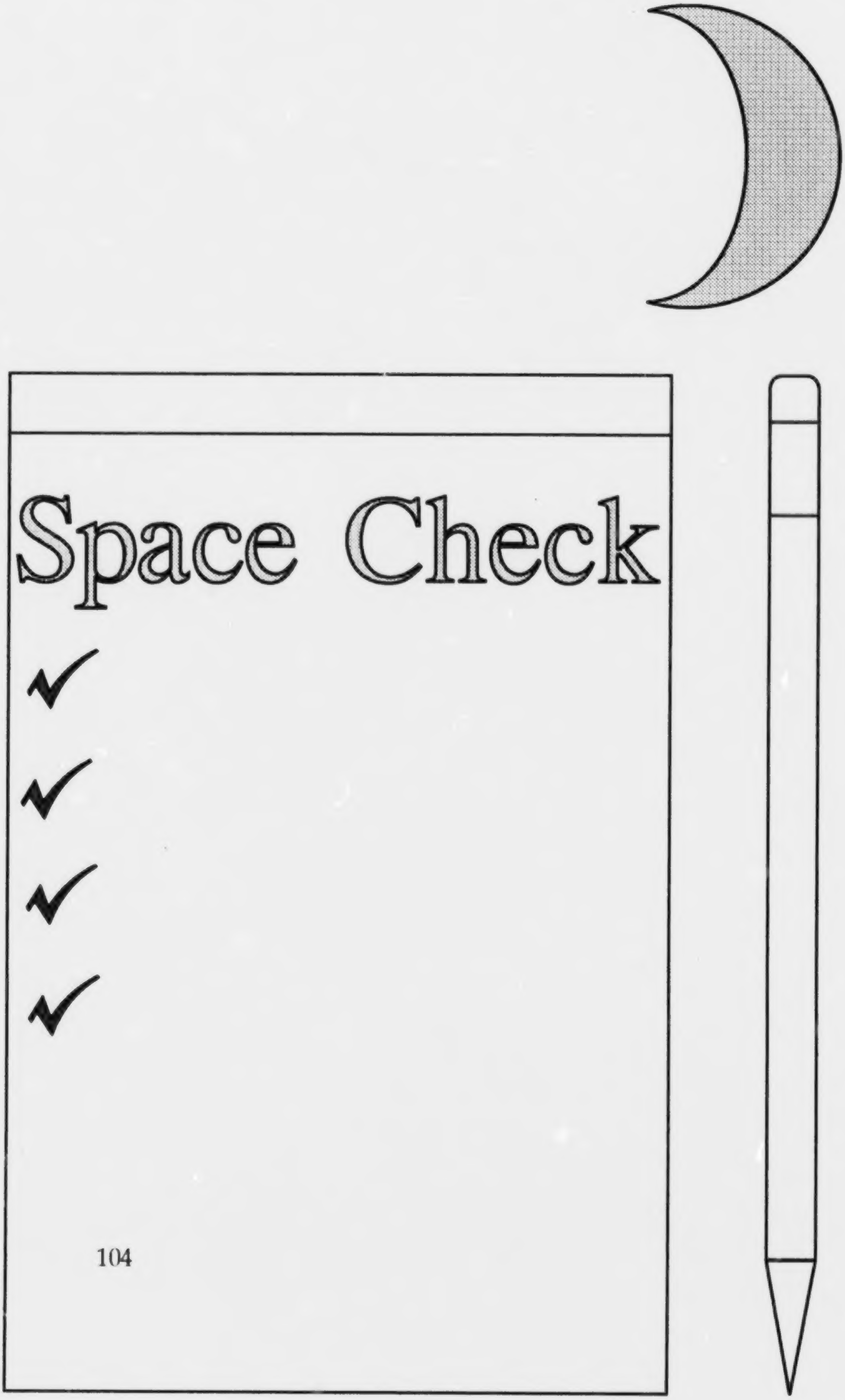
TRIP TO THE MOON

for advanced or older learners

Skill: Research and History skills.

Procedure: 1. Why was it important to President Kennedy that the United States send men to the moon? Your librarian can help you find the answer.

2. What were the memorable words that Neil Armstrong spoke when he took that first step on the moon. Does your library have a film showing this event?



Space Check

✓

✓

✓

✓

Name: **SPACE CHECK**

Skill: Health and Food Awareness.

Procedure: 1. Read about the kinds of food used in space. Look for freeze dried or dried foods, such as Tang, in the grocery store.

2. Check your physical condition to see how fit you are.

Variations: Teachers might want to plan a special day or half-day for space play. Local farmer's markets and groceries carry products that are good examples of what astronauts might eat in space. Snack and lunch could be designed around these food items. A special time, perhaps coordinated with the physical education teacher, could be used to check each child's fitness as an astronaut. To prevent this activity from embarrassing some children, try to not have a blanket test, but a test sheet for each child that would illustrate that individual's "fitness" as an astronaut.

1. Read about the kinds of food used in space. Look for freeze dried or dried foods, such as Tang, in the grocery store.

FOOD SYSTEM

The Orbiter is equipped with food, food storage, food preparation, and dining facilities to provide crew members with three meals per day plus snacks and an additional 96 hours of contingency food, in case of emergency.

WHAT DO YOU EAT IN SPACE?

About fifty different kinds of foods are available for an astronaut in space. However, he or she cannot use a knife and fork the way we do on earth, since without gravity the meat might float right off into space. He or she often squeezes food out of a tube like putting toothpaste on a brush. However, he or she can eat bit sized pieces of anything like meat or cheese.

A typical meal could be made up of beef pot roast, potato salad, chocolate pudding, and tea. Another meal could be shrimp cocktail, beef and gravy, creamed corn, bread, pineapple fruitcake, and orange-grapefruit drink.

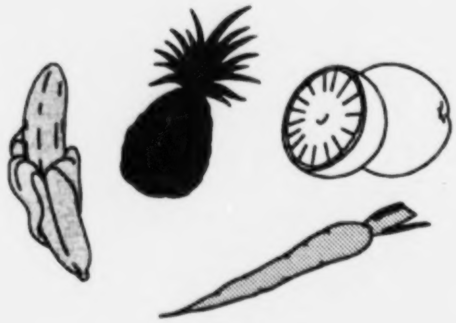
An astronaut can store enough food for one week in a package no bigger than a shoe box. Most foods are freeze-dried. One ten pound package will last a week. Remember, there is no food in space so you have to take it with you. Food in space has to be dehydrated (the water taken out of it) and compactly packed because at blast-off you must have the least weight possible and dehydrated food takes up less space. There is no refrigerator on the shuttle, but astronauts have fresh fruit and vegetables for as long as they stay fresh.

Astronauts add water to the dehydrated food when they are ready to eat. They can heat the food if necessary. If they are not careful, their food can float away. Velcro straps or magnets hold the food trays on the walls or on the astronauts' legs. You can use a styrofoam meat tray and attach yarn to it, to make a tray like the astronauts would use.

Have you ever drunk Tang? That drink was developed by NASA for astronauts. It has the same vitamins as orange juice. You can mix Tang with water in a sandwich bag with a zipping closure, then open the closure enough for a straw, and sip your drink from the bag like the astronauts do. Or you can find those juice containers at the grocery; they are very similar to what the astronauts drink from.

Many freeze dried fruits, vegetables and meats are now available in the grocery store and farmer's markets. They were invented first for astronauts, and are just becoming available for everyone. Perhaps you can get parents to bring in freeze dried foods and plan an astronaut meal to share.

If you can find "astronauts' ice cream," try some.



Use the following guideline for selecting a day's balanced meals (spread over three meals and a snack, each child should have the following each day):

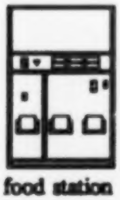
3 milk products (including cheese, ice cream, yogurt)
1 *meat, fish, poultry, eggs, nuts, beans, lentils
1 green and yellow vegetables
1 citrus fruits and tomatoes
1 potatoes, other fruits and vegetables
3 bread, rice, flour and cereal
3 to 5 cups of fluid daily is recommended.

Help the children to plan a meal they could eat in space. Help them learn to group foods into the four food groups: fruits and vegetables, breads and cereals, protein*, and dairy. Help them learn to set the table. Help them to share, wait their turn, and clean up after themselves. Help them to see that good manners would be as important in outer space as they are in their own home. When people live together, they should use good manners. In close quarters like on a space ship, good manners are even more important.

Here are some more space shuttle foods. Design a good menu using some of them:

dried apricots
vanilla instant breakfast
peas with butter sauce
chocolate pudding
noodles and chicken
pears
strawberry drink
almonds
granola with blueberries
grapefruit drink
peach ambrosia
lemonade
stewed tomatoes
macaroni and cheese
breakfast rolls
ground beef with pickle sauce

List the things you like to eat. Find ways for astronauts to eat all your favorite foods.



SPACE CHECK for advanced or older learners

Skill: Meal planning and Mathematical skills.

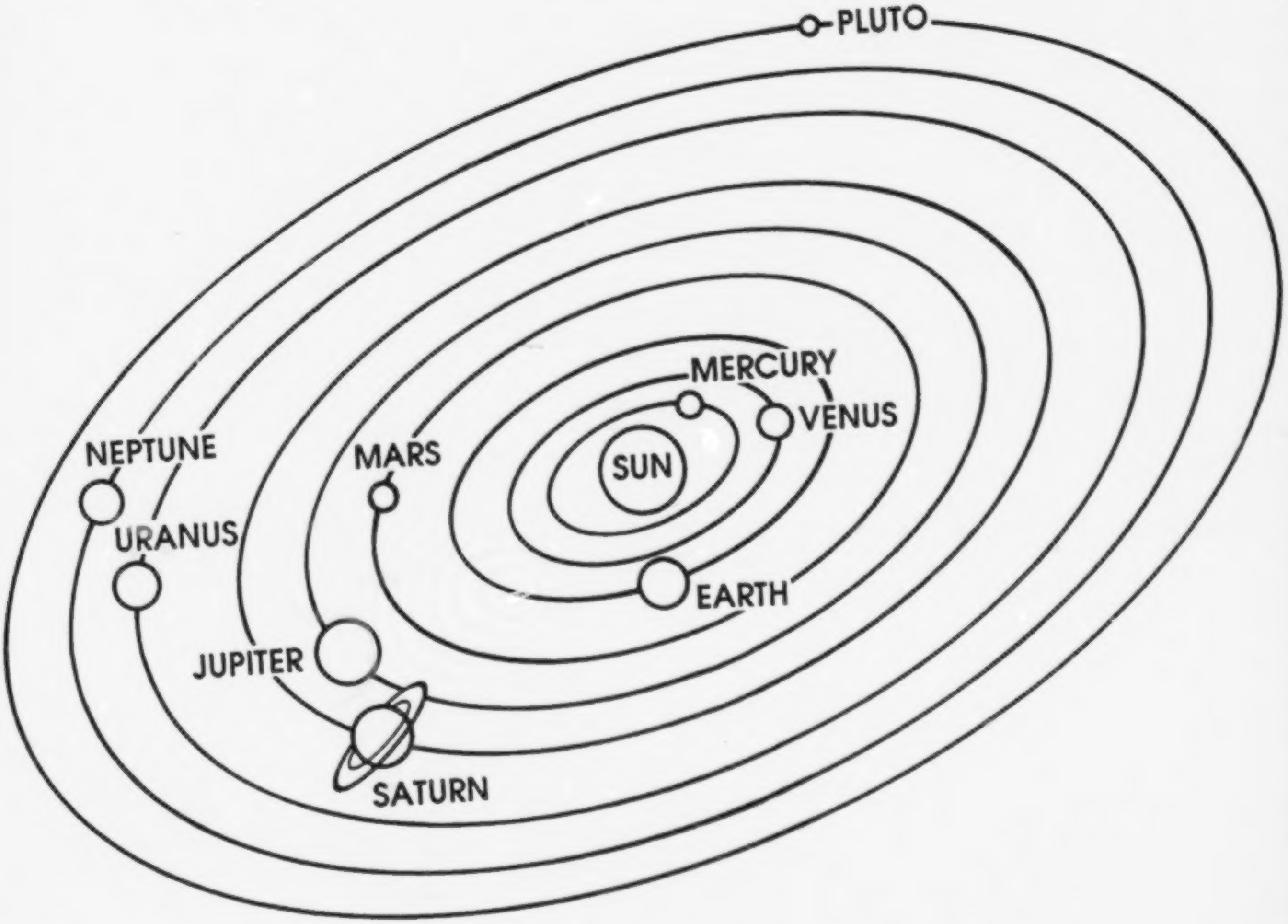
Procedure: 1. Count the number of people in your family. Plan a meal for them as if you were all on a space journey. Go to the grocery with your parents and price all of the items you would need to purchase if you were going to have that meal. List the items and the amount each costs, along with the total; and have the meal if your parents approve! You can be the space ship Cook! Give each family member a title. You might all dress for the occasion.

Sample food record:

food item	amount needed	price
1. (meat)		
2. (vegetable)		
3. (vegetable)		
4. (fruit)		
5. (drink)		
6. (dessert)		

TOTAL COST: $

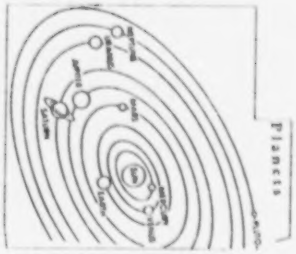
Planets


PLUTO
MERCURY
VENUS
NEPTUNE
MARS
SUN
URANUS
EARTH
JUPITER
SATURN

Name: **PLANETS**

Skill: Science and Ordering skills.

Procedure:
1. Read about the planets. Consider their names, size, and order.
2. Select an art activity to order the planets.



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1. Read about the planets. Consider their names and size and order.

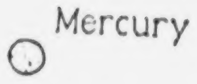
THE PLANETS

Earth

We live on a planet most of us call the **Earth**. It is also named Erta, after the Teutonic goddess of the grain. The scientific name for our planet is Terra, from the Latin *terra,* meaning earth. Earth is one of nine known planets that revolve around the Sun. Four of these planets are larger than the Earth and four are smaller. All nine planets receive heat and light from the Sun. It is hard to tell the difference between a planet and a star when you look up into the sky because the distances involved are so great. Planets appear to shine steadily in the sky while stars twinkle.

The Sun is the focal point of our solar system; it is the largest star within millions of light years of Earth and the other planets in our solar system, the Milky Way. The sun is enormous in its dimensions; all of the planets can fit in a space that equals only a small fraction of the surface area of the sun. Because of its great size, the sun exerts a gravitational force that keeps the planets revolving around it.

Someday humans will be able to take trips to the other eight planets, but for the moment, this is still only a dream. Scientists, aided by newer and better telescopes and information gathered by space satellites, are constantly learning new things about the planets, modifying what they know about them as they receive more and more information.



Mercury

The planet **Mercury** is the closest to the Sun, still a large distance of 36, 000,000 miles. It is hard to see, but it seems to be grayish or pumice colored. The planet is named for the Roman god Mercury, who ran swiftly and carried messages for the other gods. The length of each year, or the time it takes to orbit around the Sun, is 88 days. Mercury is too hot for life, because the side that faces the Sun is over 500 degrees centigrade. On the side opposite the Sun, the temperature is minus 210 degrees centigrade. Mercury is tidally bound to the Sun, so only one side ever faces the Sun. Life as we know it is not possible, because, in addition to the extreme temperatures, there is no air or water. Mercury is 36,000,000 miles from the Sun. The diameter of Mercury is 3,100 miles. Mercury has no moons.

Venus:

The planet second closest to the Sun is nearly the same size as the Earth. **Venus** is named after the Roman goddess of beauty because of the clouds that enclose this planet act like garments to hide the it. It seems to change shape, like the goddess it was named after. We call it our morning or evening star. It takes 225 days to go around the Sun. Venus is 67,200,000 miles from the Sun and its diameter is 7,575 miles. Life as we know it is not possible on Venus because of the surface conditions. The atmosphere acts like a greenhouse, allowing the Sun's heat to reach the planet's surface but trapping in the heat at the same time; therefore, the average temperature is 900 degrees Fahrenheit and there is no water or wind. There is one volcanic crater on the surface of Venus as large as the United States! Venus has no moons.

Earth:

The **Earth** is the only planet that can sustain life as we know it. The surface is covered with trees, oceans, plains, vegetation, people, and animals. The temperature on Earth varies from location to location, and cold and hot both have their spots on the planet, like the North Pole and the Tropic of Cancer. On Earth, the length of each day is 24 hours. It takes the Earth 365 and one-fourth days to revolve around the Sun. Earth is 93,000,000 miles from the Sun. The diameter of Earth is nearly 8,000 miles. Every four years (leap year), we add another day to account for the one-fourth. Earth has one moon, the Moon. Another word for our moon is Luna.

Mars:

Mars, the fourth planet from the Sun, was named for the Roman god of war. The length of each day on Mars is 24 hours and 37 minutes. It takes almost two of our years, 687 days, for Mars to travel all the way around the Sun. Mars is 141,000,000 miles from the Sun. The diameter of Mars is 4,217 miles.

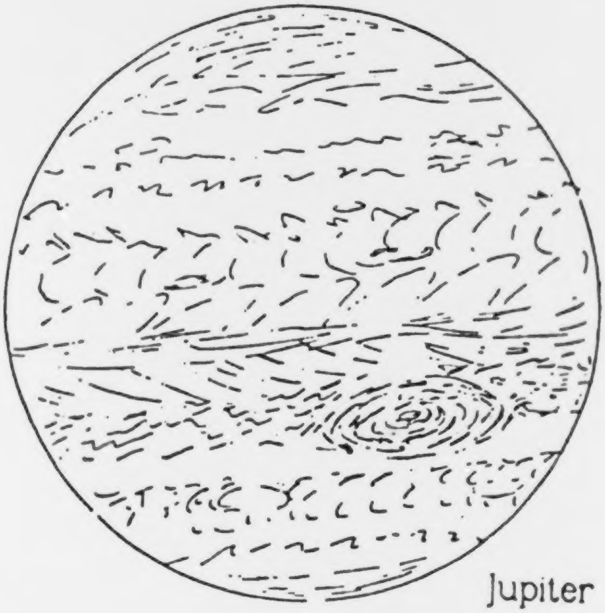
The Viking I spacecraft landed on Mars on July 20, 1976. Viking II landed on September 3, 1976. It took almost a year for each craft to travel the half a billion miles, but both landed safely. The cameras on Viking scanned 1.7 million square miles. They found rolling dunes of orange dust and volcanic rocks. Hurricane-like winds brush the surface of the planet, and patches of ice have been detected. The highest temperature on Mars recorded so far is seven degrees Fahrenheit. There appeared to be evidence that liquid water may have been on Mars about a billion years ago or that water may be underground. No life was found.

Jupiter:

Jupiter is the largest planet, the fifth from the Sun. It was named for the Roman ruler of the gods. Life as we know it is not possible, because it is too cold and there are poisonous gases present in the atmosphere. Carbon, water vapor, and heat are present, so there may well be other types of life present. The atmospheric pressure on the surface would crush any type of life known to man. Jupiter generates heat through internal pressure and turbulence, so it may not be too cold for living things of some form.

The length of a day on Jupiter (the time it takes to rotate around its own axis) is about ten hours. It takes twelve Earth years for Jupiter to go around the Sun. Jupiter is 483,000,000 miles from the Sun. Its diameter is 88,700 miles. Jupiter's moon Europa may have conditions close enough to those on Earth to sustain some form of life.

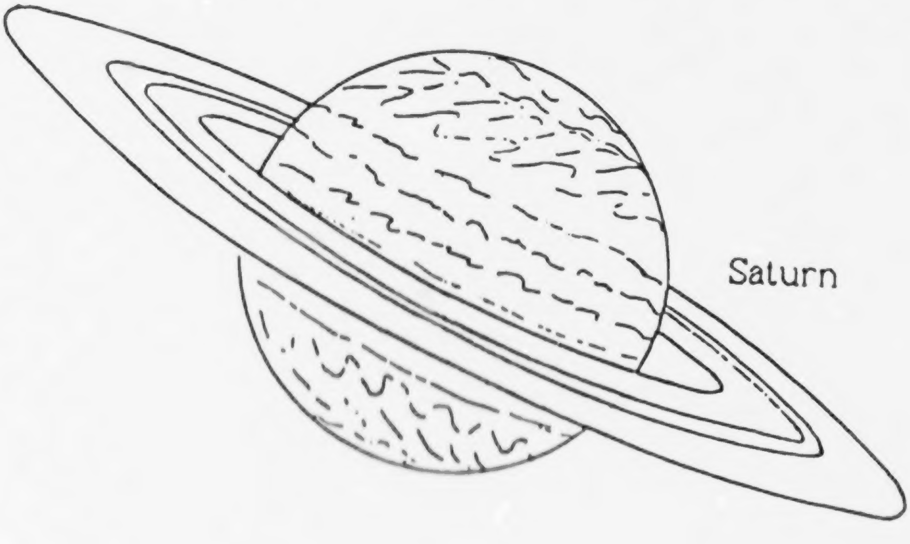
Jupiter has a Polar Region, the Great Red Spot, and bands of clouds layers, along with rings and more than twelve moons rotating around this large planet.



Jupiter

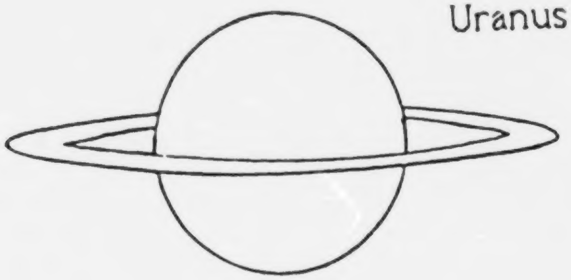
Saturn:

It takes **Saturn** about 29 and a half Earth years to go around the Sun. It is 885,000,000 miles from the Sun. It has thousands of rings, containing 21 satellites large enough to be photographed by our space probes. There are thousands of moonlets in the rings. The "shepherd" moons keep the rings defined by bumping into anything that gets in their orbits. Saturn's moon Titan may have conditions that could support life. Saturn's size in diameter is 74,000 miles. Life is not possible because it is too cold. The length of each day is 10 and a fourth hours. Saturn was named for the god of harvest who was Jupiter's father.



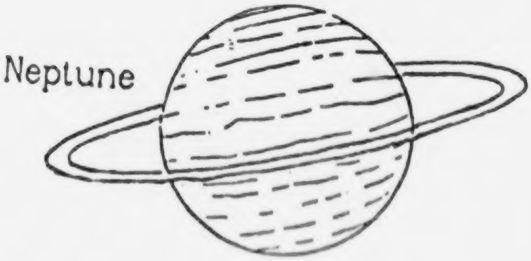
Uranus:

Uranus is blue in color, and has 15 rings and 11 moons. Uranus' day is 17.2 hours long. Life isn't possible because it is too cold. The diameter is 29,000 miles. It is 1,781,000,000 miles from the Sun. It takes 84 Earth years for Uranus to go around the Sun. It was named for the great grandfather of the Roman gods.



Neptune:

Neptune's moons go in opposite directions. Neptune may also have ring arcs, which are incomplete and sporadic rings. Neptune takes 18.5 hours to rotate, so that is the length of its day. It takes 165 Earth years for Neptune to travel around the Sun. The diameter of Neptune is 30,000 miles. It is 2,789,000,000 miles from the Sun. Neptune was named for the Roman god of fresh water and the sea.

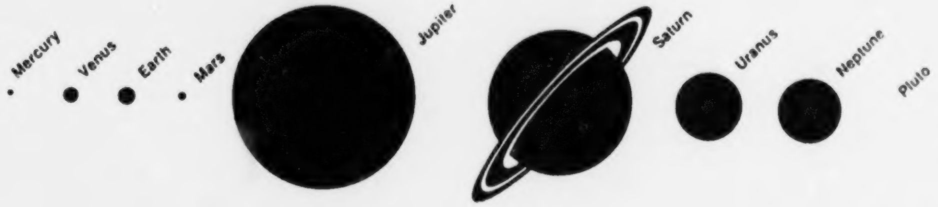


Pluto:

Pluto is the farthest planet from the Sun. However, scientists believe they may have discovered a planet even farther! Pluto is named for the Roman god of the underworld. Pluto has a moon called Charon, which was discovered at the U. S. Naval Observatory in 1978. It takes 248 years for Pluto to go around the Sun. Pluto's orbit is eccentric, or irregular, so it spends about 35 years inside the orbit of Neptune. The length of each day is 6 Earth days and 9 Earth hours. Pluto is 3,670,000,000 miles from the Sun. Its diameter is 7,000 miles.

If there is a tenth planet, it is so far away that we cannot at this time predict its position in our Solar System.

2. Select an art activity to order the planets.
   - a. You could draw the surface of any planet.
   - b. You could paint a picture of the whole solar system as seen on the front page.
   - c. You could draw the planet you would most like to visit.
   - d. You could color all the planets near their descriptions.



PLANETS for advanced or older learners

Skill: Science. Art or Game-making activity.

Procedure: 1. Using the chart in the appendix, make a bulletin board of the relative size, distance, and aspects, like moons and color, of each planet in its relationship to the Sun. The library may have things to assist you.

2. Another way you could use the chart in the appendix is to make a game about the planets. Make out cards that ask questions about the planets. Make five easy cards worth five points each, five average cards worth ten points each, and five hard cards worth twenty points each. Allow your classmates or another class to play your game. Your teacher might laminate your cards. Be creative and use your artistic skills and imagination to distinguish each kind of card -- easy, average, hard -- from each other.

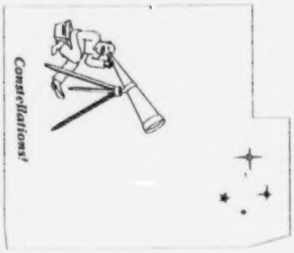
Teachers: One great class activity would be to make a "Stellar Salad." This activity, suggested by Marilyn Vos Savant, allows students to better visualize the sizes and distances of the planets. For a Stellar Salad: if the sun were a pumpkin about a foot in diameter, Mercury would be a tomato seed about 50 feet away, Venus would be a pea about 75 feet away, Earth would be a pea about 100 feet away, Mars would be a little raisin about about a 175 feet away, Jupiter would be an apple about 550 feet away, Saturn would be a peach about 1025 feet away, Uranus would be a plum about 2050 feet away, Neptune would be a plum about 3225 feet away, and Pluto would be smaller than a strawberry seed nearly a mile away. You might want to try this on the playground!

Constellations!

Name: **CONSTELLATIONS**

Skill: Visual Awareness and Reading Comprehension.

Procedure: 1. Read the stories about the Big Dipper and Orion. Study the layout of the stars in the constellations. Use stick-on stars to form the constellations.

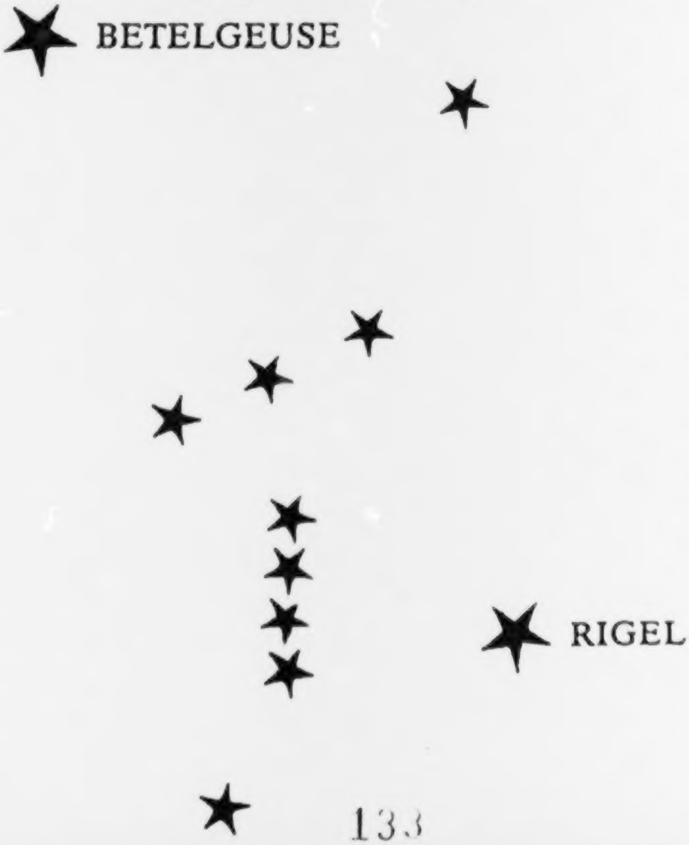

Constellations!

BETELGEUSE
RIGEL

1. Constellations are groups of stars that make a pattern. Read the stories about the constellations Orion, the Big and Little Dipper, and the North Star. Study the layout of the stars in the constellations. Use stick-on stars to form the constellations.

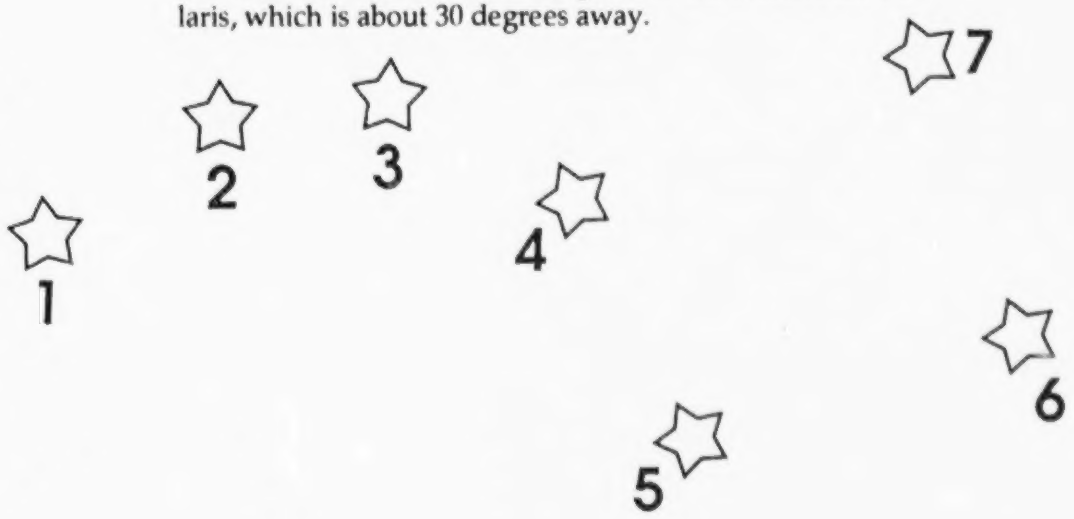
Orion

This constellation is pronounced "oh - RYE - un." Orion is a very prominent and easily recognizable constellation. It has three bright stars, close and in line, which represent his belt; two more bright stars to the north representing his shoulders; and two more bright stars to the south that are his legs. Several dimmer stars just south of the belt form his sword. Several less prominent stars show one hand holding a shield against Taurus, the bull, who is charging Orion; and the other hand holding a club. Some myths say the shield is actually a lion's skin, but myths often have different stories. The two brightest stars are Betelguese, pronounced "BET - uhl -jerz," and Rigel, pronounced "RY - jul."



The Big Dipper

The most easily recognizable constellation in the Northern Hemisphere is the Big Dipper. As its name suggests, it is shaped like an old-fashioned water dipper with the handle bent down. The Big Dipper is part of the Great Bear, a larger constellation. The Big Dipper contains seven stars. The handle of the dipper forms the tail of the bear. The rest of the dipper forms a portion of the bear's body. Other stars, not in the Big Dipper, form the rest of the bear. Alcor and Mizar, the middle stars of the handle appear to be a double star. The two outer stars of the bowl point to the North Star, Polaris, which is about 30 degrees away.



Connect the stars to see the big dipper!

The North Star

Further to the north of the Big Dipper is another dipper, the Little Dipper. It is fainter and smaller. Its handle is bent up, and the cup is narrower at the top. The brightest star is at the end of the handle and is very close to the celestial north pole. It is called the North Star, Polaris, or the pole star. Most stars rise and set, or seem to move in a big circle in the sky, but the North Star is almost exactly in the same place in the sky every night. It doesn't move in its place because the earth's axis is pointing towards it. The present North Star has not always been the North Star, nor always will be. Little by Little the earth's axis changes its directions. Several thousand years ago the star Thurham was our North Star. In some 12,000 years, our North Star will be the bright star Bega. Since the Big Dipper is easy to identify, it is used to locate the North Star. The two outer stars of the bowl are called pointers because they point to Polaris. When you find the North Star, you can see the Little Dipper pouring into the Big Dipper.

CONSTELLATIONS for advanced or older learners

Skill: Hands-on learning. Library Research. Mythology.

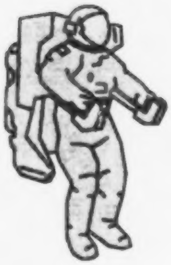
Procedure: 1. Using the sky chart from the encyclopedia, view the nighttime sky to identify particular constellations. Keep in mind the time of year when looking for constellations. Some you might try to locate include:

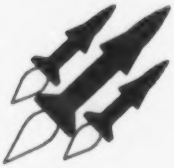
Leo, the Lion
Cassiopeia
Taurus, the Bull
Sagittarius, the Archer
Andromeda

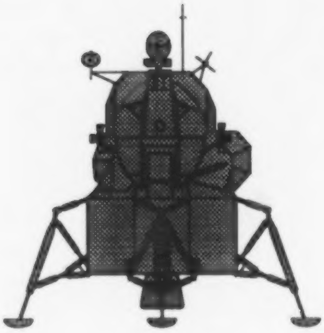
2. Visit the library to read about the Greek myths and legends, such as Daedalus, his son Icarus, and the myths about many other constellations.

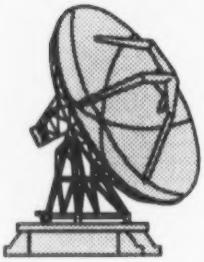
3. Horoscopes are fortunes told by the stars. Using your birthday, find out your horoscope sign. You can read it in the daily newspaper and see if it matches what you are doing.

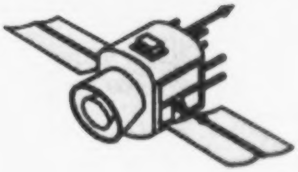
Space Collage

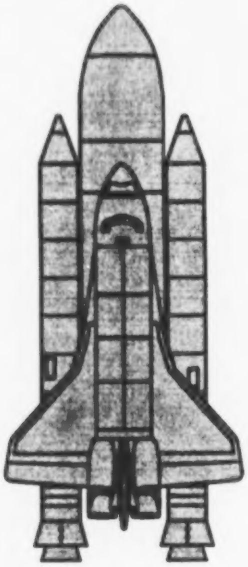


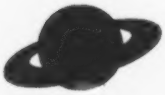










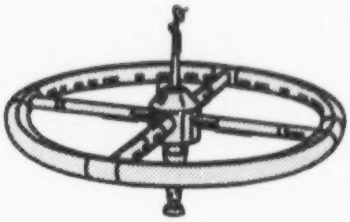


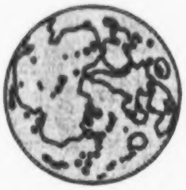
Name: **SPACE COLLAGE**

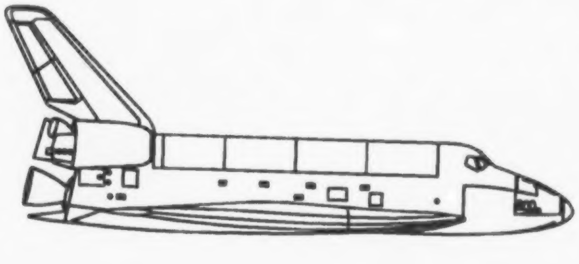
Skill: Art activity and Comprehension exercise.

Procedure: 1. You are looking out of the window of your
space ship;
rocket;
space suit;
space shuttle;
space station;
bedroom.

Draw what you see! You might use some of the items on the cover page for ideas. Use your imagination, also.







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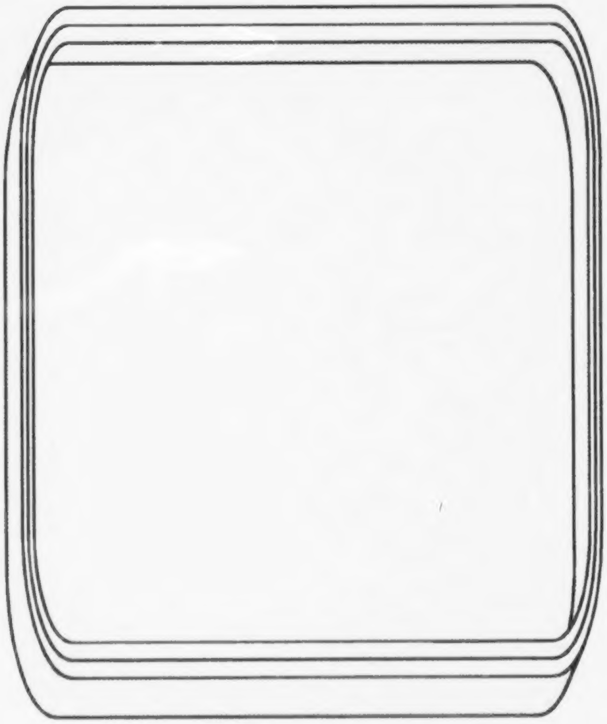


Space Education Resources

Name: **AEROSPACE EDUCATION ASSOCIATION**

Teacher / Student
Objective: Awareness of extensive resources in aerospace education through membership in AEA ($25).

Procedure: Membership includes *Aviation Space Directory* (annual); *Aviation Space Magazine* (quarterly); Wings of Aerospace Educator and membership certificate and card.
Write to:
AEA
1910 Association Drive
Reston, VA 22091

Name: **CESSNA RESOURCES**

Teacher / Student
Objective: Awareness of flight and related concepts through the *International Air Age Education Packet*.

Procedure: Write for the packets containing the following concepts: How Birds and Aircraft Fly; Parts of the Aircraft; How an Aircraft is Controlled; General Aviation at a Small Community Airport; The Total Air Transportation System.
Write to:
Cessna Aircraft Company
P. O. Box 1521
Wichitia, Kansas 67201

Name: **CIVIL AIR PATROL (CAP) RESOURCES**

Teacher / Student
Objective: Awareness of the CAP program and resources.

Procedure: Order the coloring book series on aviation giants and other aviation / space concepts. Contact your local CAP Squadron by writing Headquarters for contact officer.
Write to:
HQ CAP-USAF / PA
Maxwell AFB, AL 36112

Name: **FEDERAL AVIATION ADMINISTRATION (FAA)**

Teacher / Student
Objective: The available teacher's guide assists instructor in integrating aviation into the curriculum: communication arts, science, social studies, health and career education. Request the order form and other materials according to interest and grade level.

Procedure: Write to the Department of Transportation for free teacher's guide:
Federal Aviation Administration
800 Independence Avenue, SW
Washington, D.C. 20591

Name: **NATIONAL AERONAUTICS and SPACE ADMINISTRATION (NASA)**

Teacher / Student

Objective: Awareness of the space program.

Procedure: Write NASA to be listed on the teacher's mailing list. Pay special attention to the annual publication, *Spinoff,* to see the benefits of the space program. List some of these spinoffs such as medical research, solar energy, space food (freeze dried or dried foods). NASA's Educational Public Relations Department will offer age appropriate materials ranging from educational to art activities.

Write to:

National Aeronautics and Space Administration
Educational Affairs
Washington, D.C. 20546

Name: **SMITHSONIAN NATIONAL AIR and SPACE MUSEUM - EDUCATION RESOURCE CENTER**

Teacher / Student
Objective: The Education Resource Center of the National Air and Space Museum is open to teachers of all levels and disciplines. The ERC offers teachers access to a variety of educational materials:

Curriculum packages: Complete units on specific topics available on request for grades K-12. Write, naming specific age and topic, using school letterhead, signed by the teacher.

Filmstrips: ERC's large collection is available for preview by writing: National Audiovisual Center, 8700 Edgewood Drive, Capitol Heights, MD 20743. (301) 763 - 1896.

Public Domain Software: Aerospace related computer software for Apple II series and IBM PC computers is available both upon visiting ERC and through the mail. Teachers must provide blank diskettes. ERC has a current catalog and mail-in procedure.

Commercial Software: A growing collection of IBM PC and Apple II series commercial software is available on a preview only basis for visiting teachers.

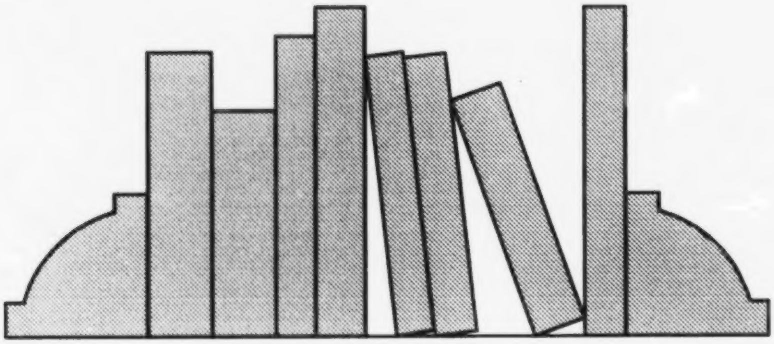
Lesson Plans: Hundreds of activities on aerospace related topics, arranged according to age and subject are available only by visiting ERC.

Videodiscs, CD-Roms, Slide Sets: Visit ERC to preview the growing collection of these new audiovisual formats.

Also, "Skylines" newsletter, ERC Workshops, and touring information can be obtained by writing to:

Educational Division, MRC 305
National Air and Space Museum
Washington, D.C. 20560
(202) 786 - 2109

Learning Resources

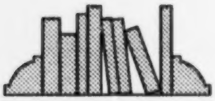


Name: INTEGRATING AIR AND SPACE INTO THE CLASSROOM

In order to integrate the study of space into the curriculum, the Georgia Department of Education has developed a new curriculum guide: Personalizing Education for Children. This guide, aimed at the kindergarten through fourth grade levels, emphasizes the integrated center theme. The format in the appendix of this guide was the basis for the following themes on aviation. Key concepts to keep in mind include:

1. Information can be communicated in a variety of ways.
2. Information can be factual or fictional.
3. Research about aviation takes a plan and needs to be accurate and clear.
4. A wide variety of resources are useful in learning about aviation.
5. The construction of aviation hardware is an intricate science.
6. Humans use technology to learn about their environment.

The center themes include: aviation language, research, drama, airline food, airplane construction. The objectives for the various center themes are broken down into the psychomotor, affective, and cognitive (creative arts, language arts, mathematics, science, and social studies).



Theme: **AVIATION LANGUAGE**

Introduction: Form two teams and let each take turns listing or defining aciation words. Put these words on cards and use in the center.

Concepts:
1. Information can be communicated in a variety of ways.
2. Information can be factual or fictional.

Objectives: The child will . . .

Psychomotor:
- --refine visual discrimination skills.

Affective:
- --develop the ability to work independently.
- --develop confidence to seek help when necessary.

Cognitive:
- --express ideas through art media.

Themes: The child will . . .

Language arts:
- --distinguish between fiction and non-fiction, reality and fantasy.
- --make comparisons using stated information.

Science:
- --extend concepts and vocabulary related to space.

Activity options: 1. Classify pictures of objects as belonging "on earth" and "in the atmosphere."

2. Read and classify word cards as described above.

3. Use word cards to make an illustrated dictionary (pictionary).

4. Use word cards and/or prepared themes to write and illustrate a book about air travel.

5. Draw or paint a factual aviation picture and tell a story about the picture.

6. Finish a story with the verbal start "If I could fly anywhere, I would go to . . ." or "Let's take a magic carpet ride . . ."

7. Sort pictures of trains, planes, automobiles, and boats according to types of transportation on land, air, and water.

8. Brainstorm things that fly.

Center materials: task cards, scrap paper, newsprint, tape recorder and tape, books about aviation, word cards, assorted pictures or drawings, crayons, paints, brushes, paper, pencils, story ideas, dictionaries.

Assessment: The child . . .

Psychomotor:

--states which visual cues were used in classifying pictures and/or words.

Affective:

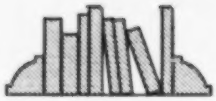
--works independently without disturbing others.

Cognitive:

--requests help when needed.

--differentiates between fact and fiction.

--uses at least five aviation words in tasks completed.



Theme: **RESEARCHING AVIATION**

Introduction: Present aviation books to children and discuss ways that we can find out about air travel. List the ideas on the chalkboard.

Concepts:
1. There are many ways to learn about aviation.
2. Research needs to be accurate.

Objectives: The child will . . .

Psychomotor:
- refine handwriting skills.

Affective:
- develop the ability to set realistic goals.
- develop the ability to use time and resources wisely.

Themes: The child will . . .

Language arts:
- demonstrate an understanding of various techniques to increase vocabulary.

Science:
- differentiate among solids, liquids, and gases.
- demonstrate light control through devices such as mirrors and lenses.

Social Studies:
- construct and interpret simple graphs and charts.

Activity options: 1. Research and draw an airplane. Label each part.

2. Plan a class play or mural scene (in the airport, coming home from a plane trip, leaving by plane to visit grandparents in another city . . .).

3. Research and list the costs of air travel including fuel, materials, and employees.

4. Classify pictures / word cards into groups of solids, liquids, and gases.

5. Visit the playground and describe experiences about gravity and weightlessness (using the slide, swings, ball tossing, dropping a stone from a high platform).

6. Make a math game by drawing hangers and planes; match the number on the plane to the number on the hanger; put the planes in numerical order.

7. Research aviation careers: mechanic, flight attendant, ticket agent, pilot, travel planner . . .

8. Invite a parent or friend in the airline or space industry to visit the class.

Center materials: books about aviation, word cards, mural paper, encyclopedias, dictionaries, newsprint, crayons, paints, brushes, paper, pencils, filmstrips.

Assessment: The child . . .

Psychomotor:

--begins making letters and numbers.

Affective:

--selects activities that are on his level.

--completes tasks efficiently.

Cognitive:
- --uses more than two sources of information in completing tasks.
- --orders objects / events by time and distance and number.
- --differentiates among solids, liquids, and gases.

Theme: **DRAMA**

Introduction: Discuss a film about flying ("To Fly," "Peter Pan," or others available in your library, resource center and reference list).

Concepts:
1. Humans learn to adapt to many environments.
2. Humans learn to play many roles in their environment.

Objectives: The child will . . .

Psychomotor:
- --perform basic movements such as locomotion and nonlocomotion skills.
- --use movement to express creative ideas.

Affective:
- --display increased confidence in ability to attempt new tasks.
- --develop the ability to accept praise and constructive criticism in a helpful manner.

Themes: The child will . . .

Creative arts:

--react to various background music with action and movements.

--express ideas through drama.

Language Arts:

--recognize, recall, and retell main ideas, sequence, cause effect.

Social Studies:

--identify, describe, and analyze ways people adapt to the environment.

Activity options:

1. Read stories about Chuck Yeager, Charles Lingberg, and Amelia Earhart. Dramatize these stories.
2. Plan and present a dramatization of ideas for future air travel.
3. Listen to records and move to the tempo and rhythm.
4. Describe this music by using fingerpaints or crayons.
5. Create a song using rhythm instruments.
6. Set up an airplane and airport in the drama center. Include: metal detector, passenger seats with seatbelts, magazines, air sickness bags, luggage racks, cardboard suitcases, flight shop, ticket booth with brochures, tickets, baggage tags, and bulletin board with sky scene and travel poster.

Center materials: prop-making materials, scissors, paper, glue, large boxes, art supplies, records ("I'm Leaving on a Jet Plane," and other flying or space songs), coloring book on aviation heroes (CAP publications).

Assessment: The child . . .

Psychomotor:

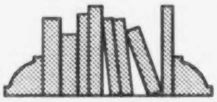
- --moves in a coordinated manner.
- --moves creatively to express ideas.

Affective:

- --expresses confidence.
- --accepts praise and criticism.

Cognitive:

- --reacts to parts of music.
- --uses drama to express ideas.
- --portrays main events, details, sequence, and cause/effect relationships in a story.



Theme: **AIRLINE FOOD**

Introduction: Each child can present foods that they believe are served on an airplane. Undesirable foods are crossed off the list with reasons provided.

Concepts:

1. A good plan is needed if cooperation between group members is required.
2. Symbols are a part of language.

Objectives: The child will . . .

Psychomotor:

- --practice and refine manipulation of objects.
- --develop sensory discrimination involving taste.

Affective:

- --develop the ability to follow directions and abide by rules.

Themes: The child will . . .

Creative arts:

--express ideas through art media.

Language Arts:

--interpret and use symbols and abbreviations in language.

Mathematics:

--read and interpret measuring symbols correctly.

Science:

--differentiate among solids, liquids, and gases.

Activity options:

1. Research to find out what foods are taken on board and how they are prepared.
2. Find recipes for food taken in the air.
3. Draw a recipe including ingredients needed. Use newspaper to estimate costs.
4. Plan a well-balanced airline meal.
5. Cook and eat the food discussed.
6. Draw pictures of the solids, liquids, and gases observed during cooking.
7. Pretend to eat snack on an airplane.

Center materials: books on aviation, encyclopedias, paper, pencils, recipe books, newspaper food section, hotplate, cooking utensils, paper plates, cups.

Assessment: The child . . .

Psychomotor:

--handles objects in a coordinated manner.

--describes foods tasted.

Affective:

--follows work outline; accepts responsibility.

Cognitive:
- --uses symbols on recipes correctly.
- --uses art to express ideas.
- --states the uses of a daily newspaper.
- --measures ingredients with assistance.
- --orders events by time and sequence.
- --differentiates among solids, liquids, and gases.

Theme: **AIRLINE CONSTRUCTION**

Introduction: Discuss what directions are for. Introduce various materials used in construction.

Concepts:
1. Constructing an airplane is an intricate science.
2. People use technology to explore the environment.

Objectives: The child will . . .

Psychomotor:
- --practice and refine manipulation of objects.

Affective:
- --develop and understanding of cooperation and planning.
- --practice respecting other people's ideas.

Themes: The child will . . .

Creative arts:
- --express ideas through art media.

Language arts:
- --interpret and use information presented through instructions.

Mathematics:

--read and make scale drawings.

Activity options: 1. Discover an energy source common to classrooms, the rubber band. Experiment to find out how this may be used to thrust an object forward.

2. Build a balsa wood plane or large styrofoam plane. Allow the children to fly it.

3. Discuss communicating from ground to air, and through the air, like radio.

4. Make paper airplanes. Have a flying contest, a decorative contest, a loop-de-loop contest, a nose-dive contest.

Center materials: instructions for plane making, books on planes, rubber bands of all sizes, lightweight objects for propelling, paper and materials for plane construction (Delta Dart Kits), paper to design a plane, crayons and stickers for decoration.

Assessment: The child . . .

Psychomotor:

--handles objects in a coordinated manner.

Affective:

--plans cooperatively.

--respects other's ideas and turns.

Cognitive:

--uses art to express ideas.

--makes drawings of ideas.

AVIATION and SPACE

Certificate of Completion

Name:

I have learned about aviation and space
through mathematics, science, language arts,
the humanities, and technology and will help
others realize the importance of aviation
and space in today's world.

teacher

school

Name: **VOCABULARY GAMES AND ACTIVITIES**

Procedure: Below is a listing of various vocabulary words relating to air and space. You may play various word games with your students in order to help them make these words more familiar to their vocabulary. Both simple and complex words are provided for your use.

Primary grade words:

balloon
bi-plane
wings
engine
hail
degree
satellite
space suit
lift-off
thrust
runway
helicopter
airplane
propeller
dew
fog
weatherman
rocket
astronaut
spacecraft
zoom
hangar
glider
aircraft
elevator
snow
water
air speed
planet
blast-off
take-off
airport
pilot
jet
airlines
lights
rain
vapor
orbit
star
countdown
gravity
aviation
baggage

Advanced words:

air density
pressure
currents
lift
drift
payload
center of gravity
barometer
temperature
wind
drag
cumulus
aerospace
knot
humidity
charts
stability
nimbus
aviator
Bernoulli's Law
atmosphere
wind velocity
weight
yaw
cirrus
navigation

VOCABULARY GAMES AND ACTIVITIES

1. Arrange the words in alphabetical order, using only the first letter.

2. Look up the definitions of the words.

3. Write or say a sentence using each word.

4. Write words on cards and group them by subject.

5. Use the words to record a short story. Some possible titles might include:
    - My First Plane Ride
    - Airplanes of Yesterday
    - Airplanes of Tomorrow
    - A Trip to the Moon
    - A Trip to Outer Space
    - Famous Aviators

6. Divide the words into syllables, on the board, clapping for each syllable.

7. Any other creative thing you can think of!

RESOURCES IN AEROSPACE EDUCATION

Aerospace Education Games and Activities for the Elementary School, Pauline Maupin, 2522 Elm Hill Pike, Nashville, TN 37214 ($5.00)

Aerospace Projects for Young Children, Jane Caballero-Hodges, Humanics Limited, PO Box 7400, Atlanta, GA 30309.

Captain Entropy, Bruce Haack, Dimension 5 Records for Children, Box 185, Kingsbridge Station, Bronx, NY 10463.

Civil Air Patrol, National Headquarters, Maxwell Air Force Base, AL 36112. Falcon Force, Horizons Unlimited, CAP Newsletter, aviation giants coloring book series, aerospace personality series.

Delta Dart Project, Midwest Products Co., 400 S. Indiana Street, Hobart, IN 46342.

Estes Rocketry and Kite Kits, Estes Industries, Penrose, CO 81240.

The Federal Aviation Administration. Office of Public Affairs, Washington, D.C. 20591. Demonstration aids, First Flight, Trip to the Airport, Teacher's Guide for Aviation Education, Delta Dart Teacher's Guide, August Martin Activity books, plus many other materials including an extensive career awareness series. Request order form.

Hi-Flyer Manufacturing Company, P.O. Box 280 Penrose, CO 81240. Kite kits and clubs.

International Air Age Education Package, Cessna Aircraft
Company, P.O. Box 1521, Wichita, KS 67201.

Jeppesen Sanderson, 56 Inverness Drive East, Englewood, CO 80112-5498. Various resources.

Make 'n Take Experiments, Ted Colton, Aerospace Resource
Center, Georgia State University, Atlanta, GA 30303.

Missionspace Teacher's Kit Media Mart, 72 West 45th Street, NY 10036.

National Aeronautics and Space Administration, Educational Affairs Division, Washington, D.C. 20546. NASA Fact Sheets, Activities for the Elementary Classroom,Elementary School Aerospace Activities (Lincoln Project), Space Shuttle Kits, Spinoffs, plus many other charts,posters, and materials. Request placement on educational mailing list.

National Air and Space Museum, Smithsonian Institution,
Washington, D.C. 20560. Educational materials.

The Ninety-Nines, An Introduction to Aviation, Inc., P.O. Box
59965, Oklahoma City, OK 73519. Coloring books.
Request various materials.

Appendix A: **Famous Aviators**

Discover when these famous aviators lived, where they lived, and that they achieved:

Joseph and Etinne Mongolfier
Jean-Pierre Blanchard
Henri Giffard
Alexander Mozhaiski
Clement Ader
Samuel Langley
Tiny Broadrick
Louis Bleriot
Glenn H. Curtiss
Jules Vedrines
Igor Sikorsky
Hugo Junkers
Lucien Bossoutrot
Howard Rhinehart
Lt. Lowell H. Smith
Amelia Earhart
Nancy-Bird Watson
Jacqueline Cochran
Yuri Gargarin
John Glenn, Jr.
Edward H. White II
Bonnie Tiburzi
Donald Slayton
Fred Haise
Anna Fisher
Mary Cleave
Sally Ride
Mike Mullen
Chiako Naito
Jean Pilatre deRozier
Sir George Cayley
Felix du Temple
Charles Renard
Otto Lilienthal
Wilber Wright
Alberto Santos-Dumont
Henry Farman
Harriet Quimby
Holden C. Richardson
Katherine Stinson
Lt. George Boyle
Cdr. Albert C. Read
Lt. Oakley G. Kelly
Charles Lindberg
Fay Gillis Wells
Erich Warsitz
Charles E. Yeager
Alan Shepard
Valentina Tereshkova
Neil Armstrong
Emily H. Warner
Joe Engle
Fredrick Gregory
Bryan Allen
Svetlana Savitskaya
Bruce McCandless II
Jon McBride

And what importance do these things have in the history of Aerospace?

Sputnik
Apollo I
Soyuz T-7
Project Mercury
Enterprise
Untethered walks
NASA
Challenger
Discovery

Appendix B: **Moon Survival**

This activity is for the advanced student, or as a class experience. It will help the student to learn about life and survival skills, and how to make wise decisions. We suggest that the teaching staff use this activity, to build teamwork and help focus on the problems involved in living in space. The average preschool or primary schooler may not have the skills or interest to participate fully in this activity.

MOON SURVIVAL

Instructions: You are a member of a space crew originally scheduled to rendezvous with a flagship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the flagship, the most critical items available must be chosen for the 200 mile trip.

Below are listed the 15 items left intact and undamaged after landing. Your task is to rank them in terms of their importance for your crew enabling them to reach the rendezvous point. Place the number "1" by the most important item, the number "2" by the second most important, and so on through number "15," the least important.

If you are working in groups, an important component of the activity is that the group must come to a consensus about the importance of each item. Be sure you understand why each item is important (or why it is not important), and be ready to explain and defend your choices within your group. NASA'S rankings and the reasons for the rank are listed on the next page. NO FAIR PEEKING! Remember, in this activity there are no wrong answers. You simply must be able to justify your choices in a reasonable manner.

Here are your items:

item	**ranking**
Box of matches	
Food concentrate	
50 feet of nylon rope	
Parachute silk	
Portable heating unit	
Two pistols	
One case dehydrated milk	
Two 100-pound tanks of oxygen	
Stellar map of the moon's surface	
Life raft	
Magnetic compass	
Five gallons of water	
Signal flares	
First Aid kit containing injection needle	
Solar-powered FM receiver-transmitter	

KEY

item	**NASA ranking/reason**
Box of matches	15, no oxygen to sustain flame
Food concentrate	4, efficient food source
50 feet of nylon rope	6, useful in scaling cliffs and tying together injured
Parachute silk	8, provide protection from sun's rays
Portable heating unit	13, useless on dark side, not needed on light side.
Two pistols	11, possible means of propulsion
One case dehydrated milk	12, bulky duplication of food concentrate
Two 100-pound tanks of oxygen	1, most pressing need
Stellar map of the moon's surface	3, primary means of navigation
Life raft	9, CO_2 bottle in raft may be used for propulsion
Magnetic compass	14, magnetic field on moon is not polarized, worthless

Five gallons of water	2, replacement for high water loss on light side
Signal flares	10, distress signal when mother ship sighted.
First Aid kit containing injection needle	7, for injecting vitamins
Solar-powered FM receiver-transmitter	5, talk to mother ship, FM needs short range and line of sight

How did your evaluation match up to NASA's?

Appendix C: **THE PLANETS: FACTS AND FIGURES**

Helpful definitions:
Diameter: measurement at the planet's equator, in miles
Distance from the Sun: average distance, in **millions** of miles
Spin Time: period of rotation, in days
Orbit Time: period of orbit around the Sun, in years
Moons: number of moons or satellites

Due to distances and other aspects which make measurements imperfect, the numbers must be rounded off and estimated. Please use the chart only to demonstrate relationships. There is no need for children to memorize the figures.

THE PLANETS: FACTS AND FIGURES

PLANET	DIAMETER	DISTANCE FROM SUN	SPIN TIME	ORBIT TIME	MOONS
MERCURY	3,031	36	59	0.2 (88 days)	0
VENUS	7,521	67	243	0.6 (225 days)	0
EARTH	7,928	93	1	1.0 (365.25 days)	1
MARS	4,217	142	1	1.9	2
JUPITER	88,732	483	0.4 (10 hrs)	11.9	16+

SATURN	74,567	885	0.4 (10.25 hrs)	29.5	20+
URANUS	31,567	1,781	0.7 (17.2 hrs)	84.0	15+
NEPTUNE	30,200	2,789	0.8 (18.5 hrs)	164.8	8
PLUTO	1,460	3,670	6.4 (6 days, 9 hrs)	247.7	1

Age appropriate for K-3 with special sections for older or advanced learners, this book is filled with fun activities for independent study or teacher guided sessions. It introduces the concepts of air and space the history of air travel and space exploration, and gives a glimpse at its future. Young minds will be exposed to the realities of space exploration and living conditions that exist in space. Such as the lack of gravity and atmosphere that cannot sustain human life. With over fifty folder game activities, ranging from the first flight to an in-depth look at the Solar System, Air and Space Activities launch the astronauts of tomorrow, today!

"This book is ideal - exactly the kind of curriculum material needed to stimulate young people to reach for the stars in their education."
-Dr. Edwin "Buzz" Aldrin, Apollo 11 Astronaut

"This is where the Air Force begins!"
-Maj. Gen. George M. McWilliams, USAF (Ret.)

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